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MASS. EA 20.2: R32/3/994

Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Environmental Protection

William F. Weld
Governor
Trudy Coxe
Secretary, EOEA
Thomas B. Powers
Acting Commissioner

November 15, 1994

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DOCUMENTS
COLLECTION

John DeVillars
Regional Administrator
U.S. Environmental Protection Agency - New England
JFK Federal Building
Boston, Massachusetts 02203

Dear Mr. DeVillars:

I am pleased to submit to EPA an amendment to the Massachusetts State Implementation Plan (SIP) for Ozone. This submittal, made pursuant to the requirements of Sections 110 and 182 of the Clean Air Act Amendments of 1990, includes planning, administrative and technical documentation and constitutes our emissions reduction plan and milestone demonstration for 1999.

This submittal and request for revision of the SIP is made in response to the Clean Air Act requirements that, by November 15, 1994, states submit a SIP revision to comply with certain requirements of Sections 182(c) of the Clean Air Act. Massachusetts has been designated non-attainment for ozone, with a classification of "serious" state-wide (56 FR 56694). For Massachusetts, the Act requires that a plan which identifies how the state will reduce emissions of volatile organic compounds (VOC) by 1999 be submitted. The plan must include a demonstration that the state will achieve an emission reduction, between 1996 and 1999, equal to 3% of the 1990 baseline emissions per year, plus any reductions necessary to offset growth in emissions during the 1990-1996 period.

This submittal is intended to meet certain requirements of the Clean Air Act, including planning documents, letters, reports, and certifications. Specific documents contained here include:

- Calculation of the 1999 Target Level of Emissions
- Demonstration of NOx Substitution Viability
- 1999 Projected Emissions Inventories
- Revised 1990 Base Year Emission Inventory
- Revised Calculation of the 1996 Target Level of Emissions and Technical Support

One Winter Street • Boston, Massachusetts 02108 • FAX (617) 556-1049 • Telephone (617) 292-5500

The Department conducted public hearings under the provisions of M.G.L. Chapter 30A on this revision on October 6, 1994 and October 7, 1994. The comment period ended on October 11, 1994. Written comments were received from the EPA as well as various other parties. Comments raised during the public review process have been summarized and are contained in this SIP revision package, along with the Department's response to those comments.

The air quality impacts of the programs contained in this SIP revision are addressed in the Reasonable Further Progress Demonstration. Economic impacts associated with the programs have been discussed within the regulatory packages for each discrete program.

In the comments received from EPA both before and during the public hearing, it was noted that the SIP revision submitted by Massachusetts in November of 1993 no longer provided for sufficient reductions in VOC emissions to achieve the required 15% reduction, net of growth, by 1996 or the expected growth in VOC emissions to 1999. The DEP has found that two programs, expected to be implemented through the Reasonable Progress Demonstration, will not achieve the anticipated reductions (Marine Volatile Organic Liquid Transfer Controls and Industrial Clean-Up Solvent Controls) and has also made two adjustments to the emissions inventory as a result of quality assurance activities. More recently, EPA issued new guidance on a third program which resulted in a further loss of expected emission reductions (Off-Road Evaporative Emissions). The result of these changes is that DEP concurs with a shortfall in our ability to achieve the reductions required by the 1996 Reasonable Further Progress Demonstration. The shortfall is approximately 20 tons per summer day of VOC emissions.

The DEP is proceeding expeditiously to release for public review a revision to the 1996 Reasonable Further Progress Demonstration that will identify new strategies and eliminate this shortfall, as well as revisions to the 1996 Massachusetts Growth Factors report. A DRAFT of the document will be submitted to the EPA under separate cover. The draft will ask for public comment on a range of strategy options to make up the shortfall, including the following:

- Increased Rule Effectiveness
- Lowering the Vapor Pressure Applicability for Volatile Organic Liquid Storage and Transfer Controls
- Expansion of Consumer Products Regulation
- Aerosol Coatings Controls
- Tightening of Standards on Architectural & Industrial Maintenance Coatings
- Landfill Gas Controls

- Economic Incentive Program for Marine Vessel Maintenance
- Cleaner Diesel Fuels Programs
- Inspection & Maintenance (I/M) for Heavy Duty Gasoline Vehicles
- Economic Incentive Program for Prime Suppliers of Gasoline or Mandated ASTM Class B Reformulated Gasoline ("Southern Reform")

We will keep your office advised of our progress in revising the 1993 plan, and expect to have a revision formally submitted to you by December 31, 1994.

Therefore, pursuant to the procedures and deadlines established Section 110(k) of the Clean Air Act and the EPA procedures for SIP review (56 FR 42216), I am submitting for your approval this amendment of the Massachusetts SIP. Should you or your staff have any questions regarding this submittal or wish any further information, please contact Barbara A. Kwetz, Director of the Division of Air Quality Control, at 292-5593.

Very truly yours,

Tom Powers

Thomas B. Powers
Acting Commissioner

TBP/ljc

att./encl.

cc: Linda Murphy, US EPA, Region I
w/o att./encl.:
Trudy Coxe, Secretary, Executive Office of Environmental Affairs
Arleen O'Donnell, Acting Deputy Commissioner, DEP
Patricia Deese Stanton, Assistant Commissioner, DEP
Barbara A. Kwetz, Director, Division of Air Quality Control, DEP

REVISIONS TO THE
MASSACHUSETTS OZONE STATE IMPLEMENTATION PLAN
NOVEMBER 15, 1994

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EXECUTIVE SUMMARY

Introduction

Section 182(c)(2)(B) of the Clean Air Act requires that, by November 15, 1994, Massachusetts submit a SIP revision that identifies steps that will be taken to further reduce emissions of volatile organic compounds (VOC) between 1996 and 1999. The revision must include a demonstration that the prescribed measures will effect an emission reduction, between 1996 and 1999, equal to 3% per year of the 1990 adjusted base year emissions, plus any reductions necessary to offset growth in VOC emissions during the 1996-1999 period. NO_x emission reductions may be substituted for VOC emission reductions, on a percent-to-percent basis, if it can be shown (1) that NO_x reductions will be consistent with emission reductions required to demonstrate attainment, and (2) that the specified NO_x reductions are accomplished prior to or within the three-year period consistent with the Reasonable Further Progress emission reduction requirement. This SIP submittal contains the Massachusetts 1999 Reasonable Further Progress Demonstration for NO_x.

The DEP is also making some adjustments to its emissions inventories to reflect quality assurance/quality control activities and to be consistent with U.S. Environmental Protection Agency (EPA) guidance, and is thereby submitting revisions to the 1990 Base Year Emission Inventory and the 1996 Target Level of Emissions Calculation.

The following is a brief description of each of the various components of this revision to the SIP:

Calculation of the 1999 Target Level of Emissions:

The Clean Air Act and subsequent EPA guidance establishes the method States must use to determine what total 1999 statewide emission level that must be met to reflect the mandated minimum reductions of the Act. Section B3 of this submittal presents those calculations for Massachusetts. The calculations were subject to public review in September - October, 1994.

NO_x Substitution Viability:

The DEP has opted to substitute NO_x emission reductions for VOC reductions. In the absence of a complete modeled attainment demonstration, the EPA will allow NO_x substitution if NO_x RACT regulations are adopted and submitted to the EPA before the rate-of-progress plan is submitted, and a regional modeling analysis supporting use of NO_x controls to reduce ozone within the domain is available. These conditions were detailed in a series of guidance documents issued by the EPA.

The NO_x RACT regulation, 310 CMR 7.19 has been promulgated by the DEP pursuant to the requirements of sections 172(c)(1), 182(b)2, 182(c), and 182(f) of the Clean Air Act. The regulation, along with documentation on comments offered at the public

hearings and the DEP's responses to those comments, was submitted to the EPA on July 15, 1994 as a revision to the Massachusetts Ozone SIP.

There has been substantial modeling done which supports the decision to substitute NO_x for VOC. Regional Ozone Modeling (ROM) results presented in the Regional Ozone Modeling for Northeast Transport (ROMNET) Project Final Report (EPA-450/4-91-002a) for strategies CS10, CS11, CS12, CS13, and CS14 indicated that maximum technology NO_x controls would produce more significant ozone reductions than stringent VOC controls in many areas of the Northeast. Along the Northeast Corridor, predicted peak values declined substantially as a result of NO_x controls, except within the New York City urban area. For Boston and vicinity, predicted ozone values approached 120 parts per billion (attainment levels) for both CS11 (maximum technology NO_x controls only) and CS14 (maximum technology VOC with NO_x mobile source controls). An executive summary of this report is contained in Section B2.

The 1999 Reasonable Further Progress Demonstration:

In order to meet the Reasonable Further Progress requirements pursuant to section 182(c)(2)(B) of the Clean Air Act, due November 15, 1994, the Department of Environmental Protection (DEP) must ensure emission reductions of 161 tons per summer day (tpsd) of NO_x by 1999. DEP is proposing to take credit for emission reductions of oxides of nitrogen (NO_x) resulting from the implementation of the following existing programs:

- NO_x Reasonably Available Control Technology (RACT) Program
- Enhanced Vehicle Inspection and Maintenance (I/M) Program
- California Low Emission Vehicle (LEV) Program
- Tier I Federal Vehicle Standards

These programs are expected to achieve the NO_x reductions necessary to meet the 1999 target level of emissions for NO_x.

The 1999 Reasonable Further Progress Demonstration can be found in Sections B3 and B4, by comparing the 1999 Calculated Target Level of Emissions with the 1999 Projected Emissions Inventory. The 1999 Projected Emissions Inventory contains the control programs Massachusetts has adopted and with which will achieve the 1999 target emission level for NO_x. The demonstration was subject to public review in September - October, 1994.

Revised 1990 Base Year Emission Inventory and 1996 Target Level of Emissions Calculation:

The revisions submitted here are the result of ongoing QA/QC activities, subsequent issuance of EPA guidance, and public comment.

The 1990 Base Year Inventory has been in development for over three years and has previously been through three EPA reviews and one public review (July 1993). The document estimates 1990 emissions of VOC, NO_x and Carbon Monoxide (CO) from all sources including stationary industrial or utility sources, area sources such as architectural coating and consumer activities, off-road mobile sources such as construction equipment, recreational vessels and airplanes, on-road mobile sources such as cars and trucks, and biogenic sources or emissions from trees and vegetation. Revisions to the 1990 Base Year Inventory can be found in Section C.

The 1996 Target Level Emissions Calculation was originally submitted to the EPA on November 15, 1993 after public review in October, 1993. The revisions, based in part on changes in the 1990 Base Year Emissions Inventory, were subject to public review in September - October, 1994. They are contained in Section D.

MASSACHUSETTS STATE IMPLEMENTATION PLAN (SIP)
SUBMITTAL SUMMARY SHEET
(November 15, 1994)

SUBMITTAL TITLE: 1999 Reasonable Further Progress Demonstration

CAAA CITATION:

Section 182(c)(2)(B)

ACTION TYPE:
- ■ Full Submittal
- ☐ Committal
- ☐ Certification
- ☐ Opt-in/Opt-out

STATUS: ■ Final ☐ Draft

SUMMARY:

Regulation: final/draft ☐ attached ■ N/A
Letter from Governor or Designee: final/draft ☐ attached ☐ N/A
Date released for public review (notice): September 6 1994
Dates of public hearings: October 6-7, 1994

Date comment period closed: October 11, 1994
Date of adoption: Nov. 15, 1994 ■ actual ☐ estimated
Effective date: Nov. 15, 1994 ■ actual ☐ estimated

Work plan: final/draft ■ attached ☐ N/A
Schedule -- adoption of program: final/draft ■ attached ☐ N/A
Schedule -- implementation: final/draft ■ attached ☐ N/A

Comments:

The attached demonstrate that the Projected 1999 Emissions Inventory will be at or below the 1999 Target Level of Emissions for NOx as allowed per EPA guidance. The shortfall noted for VOC emissions will be addressed in a forthcoming SIP revision.

These documents are based upon the final 1990 Base Year Emissions Emissions Inventory for Ozone, and include:

Background Document for the 1999 Reasonable Progress Demonstration Including NOx Substitution Rationale
1999 Target Level of Emissions Calculation
1999 Projected Emissions Inventory
1999 Projected Emissions Inventory Technical Support
Strategy Summary Sheets

Commonwealth of Massachusetts
Executive Office of Environmental Affairs
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BUREAU OF WASTE PREVENTION
DIVISION OF AIR QUALITY CONTROL

BACKGROUND DOCUMENT AND TECHNICAL SUPPORT

FOR PUBLIC HEARINGS

ON THE PROPOSED REVISIONS TO

THE MASSACHUSETTS STATE IMPLEMENTATION PLAN:

REASONABLE FURTHER PROGRESS DEMONSTRATION
(POST-1996 RATE-OF-PROGRESS PLAN)

INVENTORY ADJUSTMENTS

Regulatory Authority:
M.G.L. c. 111, Section 142B, 142D

September, 1994

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BACKGROUND DOCUMENT AND TECHNICAL SUPPORT FOR THE MASSACHUSETTS STATE IMPLEMENTATION PLAN REVISION:

REASONABLE FURTHER PROGRESS DEMONSTRATION
(POST-1996 RATE-OF-PROGRESS PLAN)

INVENTORY ADJUSTMENTS

Synopsis: *In order to meet the Reasonable Further Progress requirements pursuant to section 182(c)(2)(B) of the Clean Air Act, due November 15, 1994, the Department of Environmental Protection (DEP) must ensure emission reductions of 161 tons per summer day (tpsd) by 1999. Rather than adopt new programs, the DEP is proposing to take credit for emission reductions of oxides of nitrogen (NO_x) resulting from the implementation of four existing programs: the NO_x Reasonably Available Control Technology (RACT) Program, the Enhanced Vehicle Inspection and Maintenance (I/M) Program, the California Low Emission Vehicle (LEV) Program, and Tier I Federal Vehicle Standards. These programs are expected to achieve 193 tpsd of NO_x reductions, thus meeting the 1999 target level of emissions for NO_x. The DEP is also making some adjustments to its emissions inventories to reflect quality assurance/quality control activities.*

(1) REASONABLE FURTHER PROGRESS DEMONSTRATION (POST-1996 RATE-OF-PROGRESS PLAN)

This is the background information and technical support document for the Massachusetts State Implementation Plan (SIP) revision which will be submitted to the U.S. Environmental Protection Agency (EPA) as the Reasonable Further Progress Demonstration (Post-1996 Rate-of-Progress Plan). The Clean Air Act Amendments of 1990 require Massachusetts and other areas classified as "serious" or above for non-attainment of the ozone National Ambient Air Quality Standard (NAAQS), to submit a SIP revision containing such a demonstration by November 15, 1994. The SIP revision must describe how the Commonwealth will achieve a reduction in emissions of volatile organic compounds (VOC) by at least 3% per year over a three-year period from 1996 through 1999, net-of-growth.

Characterization of the Ozone Problem

The entire Commonwealth of Massachusetts is classified as a "serious" nonattainment area under the Clean Air Act Amendments of 1990 for the pollutant ozone. Ground level ozone, or smog, is formed when VOC combine with oxides of nitrogen (NO_x) in the presence of sunlight.

VOCs are emitted from some industrial operations, all automobiles, trucks and boats, and certain other evaporative sources. These evaporative sources include common items such as lawnmowers, paints, hairsprays, and cleaning liquids. Motor vehicle exhaust and fueling operations are a major contributing source of pollutants leading to the formation of ozone. Many VOCs are also toxic to humans, and some are suspected carcinogens.

NO_x, the other chemical component in the ozone formula, is produced whenever fossil fuels are burned, and is chiefly found in motor vehicle exhaust and in emissions from power plants, industrial boilers, and other major combustion sources. Nitrogen dioxide (NO_2), one component of NO_x, is also a respiratory irritant.

Ozone is a photochemical oxidant which can cause lung disfunction, eye irritation, and exacerbate respiratory illness. Ozone can also damage forest vegetation and agricultural crops as well as natural and synthetic materials. Ozone is an areawide, regional pollutant and occurs most frequently during hot summer months.

After four consecutive years of declining levels of ambient ozone (1984-1987), the northeast states, including Massachusetts, witnessed a sharp increase in both the number and intensity of ozone exceedances in 1988. Since then, ozone levels have declined. However, given the appropriate meteorological conditions ozone exceedances will continue to occur with unacceptable frequency until precursor emissions are further reduced. During the summer of 1993, Massachusetts experienced nine days during which the ozone standard was exceeded. As of August 1, 1994 there have been six exceedances of the standard in 1994 (although the 1994 measurements are still undergoing quality assurance and quality control procedures).

Clean Air Act Requirements

The Clean Air Act requires all states which, according to monitoring data, do not attain health based standards for ozone, to adopt and implement plans to attain the ozone standard and then maintain that standard while allowing for economic growth. The Act clearly lays out minimum steps states are required to take to: characterize emissions (emissions inventory), monitor air quality (photochemical assessment monitoring system), achieve certain minimum reductions by 1996 and 1999 (reasonable further progress demonstrations or "milestones"), plan for contingencies should a milestone be missed, demonstrate attainment of the ozone standard (photochemical grid modeling attainment demonstration), and demonstrate maintenance of the standard in the future.

Due November 15, 1994

Section 182(c)(2)(B) of the Clean Air Act requires that, by November 15, 1994, Massachusetts submit a SIP revision that identifies steps that will be taken to further reduce emissions of volatile organic compounds (VOC) between 1996 and 1999. The revision must include a demonstration that the prescribed measures will effect an emission reduction, between 1996 and 1999, equal to 3% per year of the 1990 adjusted base year emissions, plus any reductions necessary to offset growth in emissions during the 1996-1999 period. NO_x emission reductions may be substituted for VOC emission reductions, on a percent-to-percent basis, if it can be shown (1) that NO_x reduction strategies will be consistent with emission reductions required to demonstrate attainment, and (2) that the specified NO_x reductions are accomplished within the interim three-year period consistent with the Reasonable Further Progress (RFP) emission reduction requirement. In the absence of a complete modeled attainment demonstration, the EPA will allow NO_x substitution if NO_x RACT regulations are adopted and submitted to the EPA before the rate-of-progress plan is submitted, and a regional modeling analysis supporting use of NO_x controls to reduce ozone within the domain is available. These conditions are detailed in the following guidance documents issued by the EPA:

- "Transmittal of NO_x Substitution Guidance," Memorandum from John S. Seitz, Director, Office of Air Quality Planning and Standards to Regional Office Directors, December 15, 1993.

- Guidance on the Post-1996 Rate-of-Progress Plan and the Attainment Demonstration, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, EPA-452/R-93-015, January, 1994 (corrected version as of February 19, 1994).

- "Clarification of Policy for Nitrogen Oxides (NO_x) Substitution," Memorandum from John S. Seitz, Director, Office of Air Quality Planning and Standards to Regional Office Directors, August 5, 1994.

Post-1996 Rate-of-Progress (RFP) Plan

Appendices A and B contain the data which support the plan that the Department of Environmental Protection (DEP) is proposing specifically to meet the Post-1996 Rate-of-Progress Plan requirement. The following is a summary of the plan.

1. NO_x Substitution

The DEP has opted to substitute NO_x emission reductions for VOC reductions. There has been substantial modeling done which supports this decision. Regional Ozone Modeling (ROM) results presented in the Regional Ozone Modeling for Northeast Transport

(ROMNET) Project Final Report (EPA-450/4-91-002a) for strategies CS10, CS11, CS12, CS13, and CS14 indicated that maximum technology NO_x controls would produce larger ozone reductions than stringent VOC controls in many areas of the Northeast. Along the Northeast Corridor, predicted peak values declined substantially as a result of NO_x controls, except within the New York City urban area. For Boston and vicinity, predicted ozone values approached 120 parts per billion (attainment levels) for both CS11 (maximum technology NO_x controls only) and CS14 (maximum technology VOC with NO_x mobile source controls). These results indicate that the full complement of NO_x controls plus the maximum technology VOC measures may be necessary to attain the ozone standard in the Boston urban area. An executive summary of this report is contained in Appendix A.

2. Emissions Targets for RFP Plan

The calculated emission target for 1999 is based on the Base Year (1990) emissions, which were contained within the November 15, 1993 Massachusetts SIP submittal. These are summarized as follows:

Table 1.
Base Year (1990) Emissions
(in tons per summer day - tpsd)

	Eastern Mass.	Western Mass.	Statewide
VOC	900	159	1059
NO_x	840	116	956

The DEP followed the EPA's methodology for calculating the target level of emissions for 1999 using "Guidance on the Post-1996 Rate-of-Progress Plan and the Attainment Demonstration," U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, EPA-452/R-93-015, January, 1994 (corrected version as of February 19, 1994). The target level of emissions represents the level of emissions the Commonwealth cannot go beyond, as of 1999. The demonstration of meeting this target must account for economic growth as well as control measures. Assuming a full substitution of NO_x for VOC reductions, the calculated emissions targets for 1999 are as follows:

Table 2.
Emissions Targets for 1999
(in tpsd)

	Eastern Mass.	Western Mass.	Statewide
VOC	658	116	774
NO_x	703	92	795

This target emission level represents a 161 tpsd reduction in NO_x emissions from base year 1990 emissions.

3. Control Strategies

a. Point Sources: NO_x RACT

Since NO_x is a precursor to ozone formation, the Clean Air Act required the Commonwealth to develop Reasonably Available Control Technology (RACT) standards for major sources of NO_x. RACT is the lowest emission limitation that a particular facility is capable of meeting by application of control technology that is reasonably available, considering technical and economic feasibility.

The NO_x RACT regulation, 310 CMR 7.19, applies to facilities with potential emissions, before consideration of air pollution control equipment, of 50 tons per year (tpy) of NO_x. The regulation contains a combination of emissions standards and performance specifications for different sources. The RACT standards take into account the size of the emissions unit, the fuel burned, and the type of unit. Specific requirements are given for boilers, combustion turbines, reciprocating engines, and glass furnaces. There is also a requirement that RACT be defined for any individual emissions unit at a major source that is not covered by any other category (Miscellaneous RACT), that has potential emissions before air pollution control equipment of 50 tpy of NO_x.

Compliance with NO_x RACT must be achieved by May 31, 1995. A facility whose actual emissions have not exceeded 50 tpy since January 1, 1990 may apply for a restriction limiting its potential emissions to less than 50 tpy and thereby no longer be subject to the regulation.

An emissions control plan (ECP) is to be submitted to the DEP to demonstrate how compliance will be achieved. For boilers larger than 100 million Btu per hour, glass

furnaces and miscellaneous RACT, the ECPs were to be submitted by April 1, 1994. For all others, ECPs were to be submitted by June 1, 1994.

Emissions of NO_x from stationary point sources comprised 38 percent, or 360.6 tpsd of the total NO_x emissions (956.2 tpsd) in the 1990 Base Year Emissions Inventory. The expected emissions reduction from 1990 base year is 96 tpsd.

For most sources, the cost is estimated to be $300 to $2500 per ton of NO_x controlled. Facilities may apply for an alternative RACT if it will not be technically or economically feasible to comply with the emissions standard in the regulation.

310 CMR 7.19 has been promulgated by the DEP pursuant to the requirements of sections 172(c)(1), 182(b)2, 182(c), and 182(f) of the Clean Air Act. The regulation, along with documentation on comments offered at the public hearings and the DEP's responses to those comments, was submitted to the EPA on July 15, 1994 as a revision to the Massachusetts Ozone SIP. These documents are available for viewing at the DEP Boston office.

b. Mobile Sources

In its November 15, 1993 SIP, the Commonwealth submitted several mobile source strategies to achieve the required VOC emissions for the 15% rate of progress plan. A number of these strategies will also achieve significant NO_x reductions in the 1999 timeframe. They are:

Enhanced Automobile Inspection and Maintenance Program (310 CMR 60.02)
California Low Emission Vehicles (310 CMR 7.40)
Tier I Federal Vehicle Standards

These mobile source strategies will achieve a 97 tpsd emission reduction from the 1990 baseyear.

Regulations for the Enhanced Inspection and Maintenance Program, 310 CMR 60.02, are scheduled for promulgation on August 26, 1994. Regulations for the California Low Emission Vehicles Program, 310 CMR 7.40, were promulgated by the DEP on January 31, 1992. That regulation, along with documentation on comments offered at the public hearings and the DEP's responses to those comments, was submitted to the EPA on November 15, 1993 as a revision to the Massachusetts Ozone SIP. The DEP need not take any formal action to receive the benefits of the Tier I Federal Vehicle Standards Program; that program went into effect with the passage of the federal Clean Air Act in 1990.

Taken together, the point and mobile source strategies are expected to achieve 193 tpsd of NO_x reductions, thus meeting the 1999 target level of emissions for NO_x. The DEP

is proposing to take credit towards emissions reductions resulting from implementation of these programs in order to meet the Reasonable Further Progress requirements pursuant to section 182(c)(2)(B) of the Clean Air Act.

(2) INVENTORY ADJUSTMENTS

During the course of the year, quality assurance/quality control (QA/QC) activities have identified particular areas of the Massachusetts 1990 Base Year Emissions Inventories and the 1996 projected emissions inventory which needed adjustment. As these adjustments were made, certain calculations needed to be subsequently revised, i.e., the 1996 Target Emission Level Calculation and Demonstration of Meeting the 1996 Milestone. These are described as follows:

a. 1990 Base Year Inventory Adjustments for Marine Volatile Organic Liquid Transfer Operations

During discussions with EPA, it was recommended that a change in methodology would better characterize emissions in this sector. The DEP has recalculated the emissions for unloading, ballasting, venting, and cleaning activities.

In addition, in Table B.2-11 of the Inventory, the number of gallons of gasoline unloaded in the Cape Cod Canal in Barnstable County was incorrectly reported. The original number reflected the number of gallons of gasoline transported through the Canal, rather than unloaded. This number has been revised, based on more recent U.S. Coast Guard and Army Corp of Engineers data, to reflect actual unloading in 1990.

Taken together, these adjustments result in a decrease in emissions in this source category from approximately 13 tpsd to 3 tpsd. The corrected pages of the inventory are presented in Appendix C. A subsequent adjustment in the total area source inventory for 1990 has been made. Any changes in the Target Calculations and Projected Emissions Inventory for 1996 are reflected in Appendix D.

b. 1996 Projection Inventory for On-Road Mobile Sources

As a result of the QA/QC activities, it was determined that 1990 data on daily vehicle miles travelled (DVMT) were used to calculate the projected 1996 on-road mobile VOC emissions for all but three counties (Barnstable, Berkshire and Bristol). This approach was inconsistent with the required methodology. Recalculations were made for the remaining counties, using the projected 1996 on-road mobile VOC emissions.

In addition, final passage of the Enhanced I/M legislation and recent promulgation of the regulations allowed for more accurate modeling parameters to be used to define the I/M

program for the purposes of SIP planning. Additional mobile modeling runs were thus performed.

As a result of these changes, there was a difference of approximately 13 tpsd between the previous 1996 Projection Inventory and the Revised 1996 Projection Inventory: an increase in projected on-road mobile VOC emissions from 139 tpsd to 152 tpsd. Any subsequent changes in the Target Calculations and Projected Emissions Inventory for 1996 are reflected in Appendix D.

(3) PUBLIC PARTICIPATION

In developing this plan, the DEP has consulted with industry, oil, automobile, utility, construction, business, government, and commercial development interest groups, environmental and health groups, academia, residents and consumers, the Highway Department and other Transportation agencies, and counterpart agencies in the other New England and Northeast States. Their input has helped the DEP elucidate the shape and direction of the its proposals to implement Clean Air Act requirements.

As always, any and all proposed revisions to the SIP are subject to public review and comment prior to submittal to the EPA. After public review and comment, and DEP evaluation of those comments, they will be submitted to the EPA by November 15, 1994 as a revision to the Massachusetts SIP.

As required by state law, the DEP gives notice and provides the public the opportunity to review background and technical information at least 21 days prior to proposing the SIP amendments at a public hearing. To assure more adequate notice for processing an amendment to the SIP, formal notice is issued 30 days before the public hearings. Public hearings to collect comments on both the SIP submittal and the strategic plan will be conducted under the provisions of Chapter 30A of the Massachusetts General Law on:

Thursday, October 6, 1994
Springfield City Hall, Room 218
Springfield, Massachusetts
10:00 a.m.

Friday, October 7, 1994
One Ashburton Place, 21st Floor, Conference Room One
Boston, Massachusetts
10:00 a.m.

Testimony may be presented orally or in writing at the public hearings. Written comments will be accepted until 5:00 p.m. on Tuesday, October 11, 1994 at the Division of

Air Quality Control, Department of Environmental Protection, One Winter Street, 7th Floor, Boston, Massachusetts, 02108.

If there are any questions regarding this document, please contact Leah Weiss at (617) 292-5520 at the Division of Air Quality Control.

APPENDIX A

NOx Substitution Documentation: Executive Summary

N-419

United States
Environmental
Protection
Agency

Office of Air Quality
Planning and Standards
Research Triangle Park, NC 27711

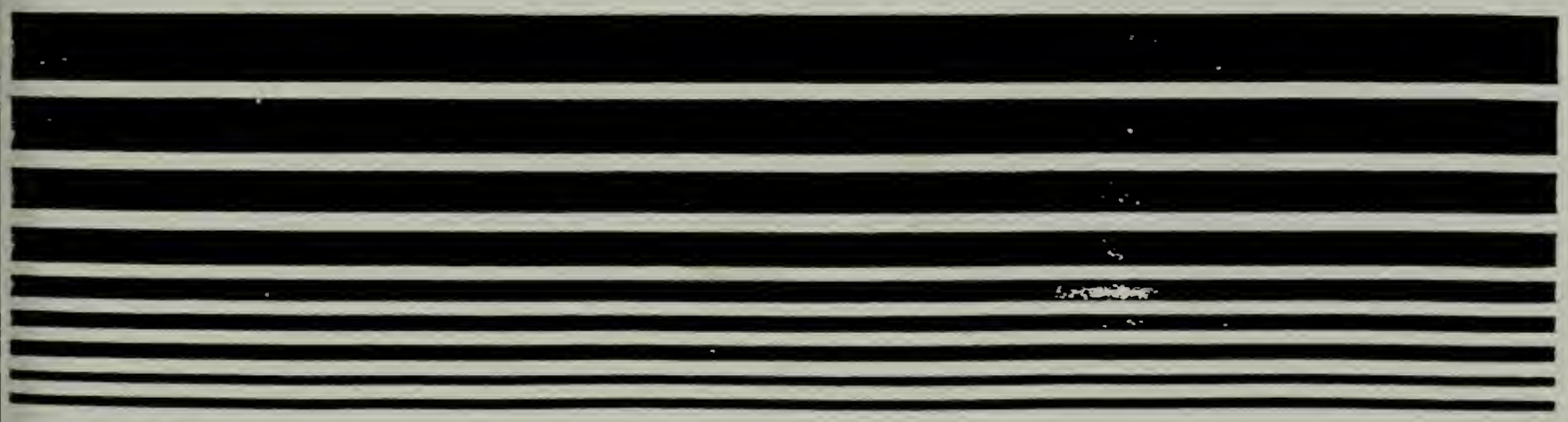
EPA-450/4-91-002a
JUNE 1991

AIR

EPA

REGIONAL OZONE MODELING FOR NORTHEAST TRANSPORT (ROMNET)

- Project Final Report -



EXECUTIVE SUMMARY

by

Edwin L. Meyer

Technical Support Division
Office of Air Quality Planning and Standards
U.S. Environmental Protection Agency
Research Triangle Park, NC 27711

INTRODUCTION

Purpose and Intent of ROMNET

The Regional Ozone Modeling for Northeast Transport (ROMNET) Project was initiated by the U.S. Environmental Protection Agency (EPA) and State and local agencies in the Northeast, as part of a joint effort to address the problem of regional transport in developing effective and equitable control programs to attain the ozone National Ambient Air Quality Standards (NAAQS) in this region.[1]

The specific goals of ROMNET are:

1. to evaluate the relative effectiveness of regional controls on ozone levels in the Northeast;
2. to provide quantitative estimates of ozone and precursor concentrations transported between urban areas following the application of regional control measures; and
3. to provide procedures and guidance for incorporating ozone and precursor transport in future State Implementation Plan (SIP) development.

The intent of ROMNET is for EPA and State decision-makers to use the findings in guiding ozone policy development and planning for potential regional control programs, as well as in urban area specific strategy evaluations. The urban-scale analyses are to be conducted by the States as part of the SIP process. The results and guidance from the project will enable States to quantify changes in future levels of ozone and precursor transport expected to follow implementation of nationwide Federal measures, local control programs in upwind cities, and potential regional strategies.

The remainder of the Executive Summary provides a brief overview of the major components of the project including:

- the project scope and organization;
- the ROMNET technical program;
- the findings from the Regional Oxidant Model (ROM) simulations, conducted to address the "strategic" issues regarding the effectiveness of regional control scenarios;
- the mechanisms and procedures developed to enable States to explicitly consider regional and interurban transport in preparing ozone SIPs; and
- a summary of the major accomplishments of the project.

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1. An exceedance of the NAAQS is defined as a daily maximum 1-hour ozone concentration > 0.12 ppm (124 ppb). The NAAQS is not to be exceeded more than once per year, on the average, at any location.

Readers interested in a detailed description of these topics and other aspects of ROMNET are referred to the numbered sections of this report. Note: all figures and tables are placed at the end of the Section in which they are referenced.

Project Scope and Organization

A fundamental concept of ROMNET was the active involvement of State and local agencies with the EPA in designing and conducting the project. The project began with the development of a protocol by EPA and State representatives. The protocol established the project goals, direction, organizational structure, technical tasks, and schedule. The ROMNET protocol is included in Appendix A of this report. The organizations participating in ROMNET are listed in Table ES-1. The geographic area covered by the project is shown in Figure ES-1.

The participation by States in the management and technical aspects of ROMNET was fostered by the organizational structure shown in Figure ES-2. This structure provided a means for States and other participants to have a major role in the project decision-making process, and for communicating information on project activities to all participants.

The Management Review Committee consisted of senior managers from State/local agencies and EPA Regional Offices, the Office of Air Quality Planning and Standards (OAQPS), and the Atmospheric Research and Exposure Assessment Laboratory (AREAL). The responsibility of this committee was to provide overall direction for the project. The three technical committees (Emissions, Strategy, Modeling) consisted of representatives from the participating organizations having expertise in one or more of the technical areas.

To ensure close coordination among the committees, the Program Director, Technical Coordinator, and chairmen of the Management Review Committee and three technical committees were drawn from OAQPS. The Program Director had the overall responsibility of ensuring the technical adequacy of the study, making sure that participants were informed of the project's status and that the project was as responsive as feasible to directions from the Management Review Committee. The Technical Coordinator assisted the Program Director by managing day-to-day activities of the project, establishing priorities for a diverse set of technical tasks, making sure these priorities were observed, and ensuring that technical activities were integrated appropriately.

Decisions by the committees were made through a consensus building process. For technical issues, straw man proposals were typically formulated by the EPA for discussion by committee members. Consensus recommendations from the technical committees on issues such as strategy selection were made to the Management Review Committee which, through consensus, provided resolution or direction on the particular topic.

THE ROMNET TECHNICAL PROGRAM

The ROMNET technical program consisted of three major components:

1. simulations using the ROM for various emissions scenarios designed to address "strategic" issues relative to the impacts of regional control measures on ozone levels in the Northeast;

2. the development of the Gridded Model Information Support System (GMISS) to manage ROM data sets and provide a means for States to easily access and retrieve data necessary to develop transport estimates and certain other inputs required for urban-scale SIP modeling; and

3. the development of the ROM-Urban Airshed Model (UAM) Interface Program System which, through a series of computer programs, translates and reformats ROM data sets into inputs to the UAM.

The remainder of this part of the Executive Summary provides an overview of the ROM and the procedures followed for simulating the impacts of control strategies. The results of strategy simulations are presented later, as is a brief description of GMISS and the ROM-UAM Interface.

The Regional Oxidant Model

The ROM Version 2.1 (Milich *et al.*, 1991) was used for estimating ozone concentrations across the Northeast under various emissions scenarios selected for evaluation as part of ROMNET. The ROM is a three-dimensional photochemical grid model, with a horizontal grid resolution of $^1/_6°$ latitude by $^1/_4°$ longitude (approximately 18.5 km x 18.5 km in the Northeast). Vertically, there are three layers. Two layers lie between the surface and the base of a subsidence inversion serving as a vertical lid on pollutant dispersion during fair weather conditions. Dimensions of the three vertical layers vary diurnally in response to physical processes occurring in the atmosphere.

As shown in Figure ES-3, five broad classes of input information are needed to drive the ROM model. The ROM Processor Network is a series of computer programs (i.e., preprocessors) that convert raw input data into the variables required by the ROM Core Model. The Core Model performs the horizontal

and vertical transport and chemistry calculations that estimate ozone concentrations (and concentrations for 34 other chemical species) for each grid cell in the domain. Chemistry assumed in the ROM Core Model is described by the Carbon Bond 4 (CB-IV) mechanism (Gery *et al.*, 1989). This mechanism is identical to the one contained in the UAM, recommended by the EPA for use in SIP attainment demonstrations. The ROM generates 30-minute concentrations that are aggregated to hourly averages. These data represent grid cell average values. A more detailed discussion of the ROM is contained in Section 2.

Procedure to Address Strategic Issues

The following steps were followed to address strategic issues on the relative effectiveness of control strategies:

1. Meteorological episodes were selected for simulation by the ROM.
2. A base case inventory was developed; an evaluation of the ROM was performed by comparing predicted base case ozone levels with observed values.
3. Base case emissions were projected to an agreed upon future year; "future baseline" predictions were simulated.
4. Control measures were applied to future baseline emissions to derive control strategy (CS) scenarios; post-control ozone levels were simulated.
5. Predictions for the different strategies and the future baseline scenario were analyzed and intercompared relative to the strategic issues.

Steps 1-3 are described next, followed by the strategic issues, the associated emission control strategies, and the conclusions drawn from ROM simulations.

Episode Selection

Two factors were considered in selecting episodes to simulate with the ROM: (1) ambient ozone concentrations and (2) wind flow patterns. Because the primary focus of the study was the Northeast Corridor, the selection of episodes focused on conditions in this portion of the domain.

First, ozone data reported in the EPA's Aerometric Information and Reporting System (AIRS) were reviewed for the years 1983-88 to identify episodes having at least three consecutive days with ozone levels > 125 ppb within the Corridor. The 27 episodes identified by this process were then ranked in terms of the magnitude of daily maximum ozone levels and the frequency of high concentrations.

Next, the 10 top-ranked episodes were examined to ascertain the occurrence of key wind flow patterns. The goal was to choose episodes featuring a variety of wind flow regimes typically associated with high ozone including (in order of priority): along Corridor transport, stagnation/recirculation, and westerly wind flow.

The period July 2-17, 1988, was identified by the above process as the most severe in terms of ozone concentrations and as having a high frequency of along Corridor and westerly wind flow patterns. Thus, all control strategies were simulated with this episode. A second episode, June 9-20, 1983, also contained high ozone levels but was characterized by recirculation conditions. This period was chosen for simulating a subset of emissions scenarios in order to test the robustness of conclusions drawn from simulations with the July 1988 episode. In addition, the two most severe 1985 episodes (August 7-16, 1985, and July 7-22, 1985) were chosen for a ROM performance evaluation. A more complete discussion of the episodes selected and the selection process is given in Section 3.

ROMNET Base Case Inventory

Inventories for volatile organic compounds (VOC), nitrogen oxides (NO_x), and carbon monoxide (CO) used in ROMNET were derived from the 1985 inventories compiled as part of the National Acid Precipitation Assessment Program (NAPAP) (see Section 4). The following modifications were made to the NAPAP 1985 inventories as part of ROMNET:

1. Biogenic emissions (primarily VOC emissions from vegetation) were calculated and included in ROM simulations. The EPA Biogenic Emissions Inventory System (BEIS) (Pierce *et al.*, 1990a) was used to derive hourly biogenic emissions estimates for the ROMNET domain.
2. Mobile source emissions were upgraded twice using MOBILE3.9 and then MOBILE4, to obtain estimates for mobile source exhaust and evaporative emissions. An earlier version of the MOBILE model was used in NAPAP. MOBILE4 (EPA, 1989) considers such recently-identified phenomena as evaporative running losses; it also contains an improved treatment of mobile source evaporative emissions as a function of temperature.

Both biogenic emissions and mobile evaporative emissions can be very temperature sensitive. Emissions of certain biogenic species are also sensitive to sunlight intensity. Because biogenic and mobile emissions constitute major portions of the VOC inventory, day-specific meteorological data were used to derive gridded hourly emissions for these categories. In addition, emission factors and/or activity levels from six stationary-source VOC categories were adjusted to reflect higher temperatures and enhanced activity levels likely on typical sunny and warm episode days.

A more complete description of the 1985 base ROMNET inventory is contained in Section 4.

ROM Evaluation

Predictions obtained with the ROM using the 1985 base inventory described above were compared with ozone observations made on 26 days during the two selected 1985 episodes. Three types of tests were performed.

1. Unpaired aggregate distributions of observations and predictions were compared for each of five subregions of the domain.
2. Observed and predicted spatial patterns for daily maximum ozone were compared through inspection of contours of observed and predicted concentrations.
3. The model's ability to specify boundary concentrations for an urban-scale domain was assessed by comparing boundary condition ozone concentrations calculated from ROM predictions with concentrations derived subjectively from ambient ozone measurements.

Results of the first test indicate agreement within ±10 percent between the predicted upper-50th percentile of the distributions (except for the very highest values) and the observed distributions, except in the southwestern portion of the domain. In this area, there was a tendency to underpredict the higher end of the observed distributions. Also, there was a uniform tendency to overpredict the lowest end of the observed distributions. A more detailed discussion of the ROM evaluation is provided in Section 2. Within the limits of this evaluation, ROM performance appears satisfactory for estimating episodic ozone levels for use in assessing regional-scale concentrations and patterns. Results tend to confirm that regional-scale models may not have sufficient resolution to simulate the fine-scale spatial structure of individual urban plumes.

Future Baseline Emissions

The year 2005 was selected for the "future baseline" scenario. This year represents a period far enough in the future to allow for widespread penetration of new control measures. It is also within the bounds of credible growth forecasts.

The 2005 baseline reflects composite effects of growth, retirement of old sources, and the impact of control programs in place or committed to as of 1988. Emissions projected to 2005 also consider the best assessment of State participants concerning rule effectiveness and penetration for existing control measures. In essence, the 2005 baseline addresses the question: "What might happen in 2005 under existing or already planned control programs, if no new measures were added?"

Regionwide reductions in VOC, NO_x, and CO emissions between 1985 and the 2005 baseline were 35 percent, 4 percent, and 45 percent, respectively. Within the Corridor, the net change in VOC and NO_x emissions between 1985 and 2005 was 34 percent and 6 percent, respectively. Section 4 contains more detailed specifications on the development of the 2005 baseline emissions scenario.

Results from applying the ROM for the 2005 baseline using the July 1988 episode indicate that present control measures (i.e., pre-1990 Clean Air Act amendments) will be insufficient to reduce maximum daily ozone to below 125 ppb everywhere in the domain. In the Corridor, episode maximum ozone concentrations are reduced by 5 to 15 percent, with predicted peak values remaining over 200 ppb in and near New York City. In the western part of the domain, ozone is also reduced by 5 to 15 percent near several major cities. However, the areal extent of predicted episode maxima $\geq$ 125 ppb has been reduced (see Section 5 for greater detail).

STRATEGIC ISSUES AND SIMULATED CONTROL STRATEGIES

Strategic Issues

The ROMNET control strategies were formulated to examine five strategic issues:

1. What are the relative benefits of VOC and NO_x controls in reducing required ozone levels?
2. What is the impact of reducing regional transport on ozone concentrations in the Northeast Corridor?
3. What levels of VOC and/or NO_x emissions reductions are necessary to reduce predicted ozone levels in the Northeast to below 125 ppb?
4. What are the effects of reactivity based strategies in reducing regional ozone levels?
5. How does uncertainty in biogenic emissions affect conclusions drawn about the benefits of controlling anthropogenic sources?

Twenty-four control strategies (CS01 through CS25, excluding CS04) were simulated to address these issues. Table ES-2 summarizes the strategies and notes the corresponding strategic issues.

Simulations for the 2005 baseline and CS19 were repeated with the June 9-20, 1983, episode to note the sensitivity of conclusions relative to differing meteorological conditions. Details of the control measures in each strategy, as well as the resulting net changes in VOC, NO_x, and CO emissions, are provided in Section 4.

Findings for Strategy Simulations

Conclusions drawn relative to the five strategic issues addressed by ROMNET control strategies are summarized below. The analyses that led to these findings are contained in Section 5 of the report. Urban areas discussed below are defined by Metropolitan Statistical Area/Consolidated Metropolitan Statistical Area (MSA/CMSA) boundaries.

Issue #1

What are the relative benefits of VOC controls versus NO_x controls in reducing ozone levels across the region?

- Maximum technology NO_x controls appear to produce larger ozone reductions than stringent VOC controls in many areas of the Northeast. The larger reductions are particularly notable in the western portion of the region, where biogenic VOC emissions are highest and a large component of NO_x emissions are rural point sources. In the Corridor, except for New York City, NO_x controls tend to reduce the spatial extent of high ozone levels, whereas VOC controls are more effective in reducing the peak values. Combining VOC and NO_x controls provides both benefits by reducing the magnitude and spatial extent of high ozone concentrations.
- In the presence of stringent VOC controls, peak ozone levels appear to be more sensitive to mobile source rather than point source NO_x emissions reductions in several cities (e.g., Philadelphia, Boston, Detroit, and Cleveland). In areas dominated by NO_x point sources, (e.g., Pittsburgh and Charleston, WV), point source controls are more effective than mobile source reductions.
- In New York City, NO_x controls alone or with VOC controls are counterproductive relative to VOC controls for short-term peak concentrations and population exposure. This effect is most prominent in the core of the urban plume and appears to be associated with high NO_x emissions in the center of the urban area. Outside the main plume, ozone levels are actually reduced by NO_x controls. For longer averaging times (e.g., episode mean 8-hour daily maximum averages) NO_x plus VOC controls produce lower ozone levels than VOC controls alone.
- The relative benefit of VOC versus NO_x controls varies by day (i.e., as a function of meteorology) in some cities. This variation was particularly evident in the Baltimore/Washington, DC area.

Issue #2

What is the impact of reducing regional transport on ozone concentrations in the Northeast Corridor?

- In the pre-control scenario, 2005 baseline ozone levels are not substantially impacted by reducing transport into the Corridor except in Baltimore/Washington, DC and in southeast Pennsylvania. These areas are closest to the portion of the Corridor boundary having the greatest incoming ozone levels during this episode. It is possible that conditions in other episodes might produce a greater impacts in other portions of the Corridor. Still, even in these two areas, the impacts are small relative to the level of predicted ozone for the 2005 baseline.
- In the post-control scenario, ozone transport was found to be very important. The results suggest that without stringent upwind controls, ozone levels in parts of the Corridor may not be reduced to below the concentration specified in the NAAQS even with stringent controls along the entire length of the Corridor. Again, the effects are most pronounced for cities near the upwind boundary of the Corridor.

Issue #3

What levels of VOC and/or NOx emissions reduction are necessary to reduce predicted ozone concentrations in the Northeast to below 125 ppb?

- Stringent maximum technology VOC and NO_x controls may be necessary in all areas of the Northeast Corridor.
- Additional reductions of VOC on the order of 64 percent in New York City and 54 percent in Baltimore/Washington, DC also may be needed. At present, this level of emissions reductions is beyond known or envisaged control technologies.
- The effectiveness of the most stringent control strategy in reducing ozone to $\leq$ 125 ppb was confirmed using an alternate meteorological episode.
- Application of stringent NO_x controls in New York City is counterproductive. Ozone levels approach 125 ppb as VOC controls are increased. It appears that even without NO_x controls, stringent VOC technology and reactivity-based measures may be needed in this urban area.
- Considering rule effectiveness and a more realistic representation of control programs (e.g., fleet turnover), results show predicted episode maximum ozone levels of just above 125 ppb in most sections of the Northeast Corridor with the most stringent VOC/NO_x/reactivity-reduction strategy simulated. The exception is New York City, where the peak ozone level is predicted to be 140 ppb.

Issue #4

What are the effects of reactivity-based strategies in reducing regional ozone levels?

- Reactivity-based strategies, similar to those simulated in ROMNET, may provide the greatest benefit in large urban areas that are VOC-limited and, thus, are more responsive to changes in VOC emissions. In such areas, reactivity-based measures could provide reductions in ozone levels comparable with that provided by a stringent technology-based approach. Also, reactivity measures may counterbalance the negative impact of NO_x controls in New York City and other areas that show a similar response.
- In other Northeast Corridor cities, and by extension, cities that respond to both VOC and NO_x controls, reactivity measures may produce a notable reduction in daily maximum ozone levels $\geq$ 125 ppb. However, for the Corridor cities, the reduction provided by the reactivity measures was only half of that from the technology-based VOC controls and a factor of 4 less than that from the VOC plus NO_x controls.
- In other, more peripheral sections of the Corridor, the relative benefits of VOC technology controls alone or with NO_x controls far outweigh the benefits of reactivity-based controls.
- In cities outside of the Corridor that were found to be most sensitive to NO_x controls, there was less reduction in ozone from the reactivity measure compared with the technology-based controls.

Issue #5

How does the large uncertainty in biogenic emissions alter conclusions regarding the effectiveness of control measures?

- ROM simulations with "best estimate" biogenic emissions yield predicted ozone concentrations closer to observed values than those simulations with biogenic emissions at either end of the uncertainty range ($\pm$ a factor of 3). This result provides some added confidence in the emissions rates used in ROM strategy simulations.
- The sensitivity of predicted ozone levels and population exposure to biogenic uncertainty varies considerably from city to city. In general, there is a greater sensitivity with increasing biogenics at the high end of the uncertainty range than at the lower end.
- If biogenics were at the "low" end of the range, predicted ozone in Pittsburgh and Detroit would fall below 125 ppb with the controls implied by proposed 1989 Clean Air Act legislation (CS05); all other cities would still be above this level (note that predicted ozone in Charleston, WV, is below 125 ppb with "best estimate" biogenics).

- With the application of stringent controls that reduced peak ozone to below 125 ppb with "best estimate" biogenics (CS19), ozone levels rise well above this level in the "high" biogenics scenario in all cities except Pittsburgh and Charleston. Thus, if biogenics are actually near the high end of the uncertainty range, then additional controls providing reductions in emissions beyond those in CS19 will be needed in many of the Northeast cities.

Implications of Findings

There are several broad implications that can be drawn from the above findings. These are:

1. Significant reductions in anthropogenic emissions along the entire Northeast Corridor will likely be necessary in order to reduce ozone to less than 125 ppb throughout the Corridor.
2. Along with VOC controls, NO_x control measures should be considered in strategies to reduce ozone levels in most areas of the Northeast. However, close examination of the potential effects of NO_x controls should be made to ensure that such controls will not be counterproductive.
3. The types of control measures and the degree of emissions reductions necessary to reduce ozone to less than 125 ppb will likely vary between cities along the Corridor. That is, a single set of controls common to all areas may not be the most effective approach for reducing ozone throughout the Corridor.
4. Areas outside the Northeast Corridor may have to add controls, beyond those necessary to solve their local problem, in order to reduce transport into the Corridor sufficiently for concentrations to be reduced below 125 ppb throughout the Corridor (even with stringent controls in the Corridor).
5. The control technologies needed to achieve the emissions reductions necessary to reduce ozone to below 125 ppb in most of the major Northeast Corridor cities are currently not available. Therefore, a high priority should be given to development and testing of controls for both VOC and NO_x sources along with enhancing enforcement procedures to achieve the highest degree of control effectiveness possible.
6. Regional strategy assessments of the type performed in ROMNET are useful for examining the regional perspective to control impacts and transport. However, urban-scale analyses will also be needed to develop local control targets and to establish a menu of specific control measures for individual nonattainment cities.

Caveats

There are three broad caveats to the findings and conclusions discussed above:

1. *The relatively coarse grid cell size in the ROM (a horizontal grid size of ~18.5 x 18.5 km) and limited vertical differentiation (two layers within the daytime atmospheric boundary layer).* Emissions are injected as a total flux by layer for each grid, and thus the fate of emissions from individual point sources is not treated explicitly. Concentration estimates are grid cell (horizontal and vertical) average values for each layer. This type of emissions estimate may in part explain why the model tends to underpredict observed peak ozone concentrations associated with sharp concentration gradients and overpredict minimum values affected by titration from local sources of NO. In ROMNET, the large grid size may affect conclusions regarding NO_x control, because a large fraction of NO_x emissions emanate from individual point sources, particularly in areas outside the Northeast Corridor. Also, the tendency to smooth out peak values may affect findings on the level of emission controls necessary to reduce ozone to < 125 ppb.
2. *The emissions inventories used in ROMNET.* As indicated previously, there are large uncertainties in biogenic emissions. Also, even though the NAPAP emissions data were subjected to extensive quality assurance, there remains some unquantified level of uncertainty in base case anthropogenic emissions. The representativeness of growth factors for estimating future year emissions as well as the efficiency and effectiveness of controls adds to the uncertainty in emissions scenarios. Thus, the findings from ROMNET should be used to help establish control directions and approximate starting points for States to begin strategy evaluations using more recent (1990), locale-specific, quality-assured inventories.
3. *This study concentrated heavily on one episode (July 2-17, 1988).* This episode was the most severe of all episodes in the Northeast, at least as far back as 1980. Although the episode included several of the meteorological conditions typical of ozone episodes in this region, consideration of a wide range of meteorological scenarios was not possible for the strategy simulations. Thus, the results (particularly regarding the effects of NO_x controls and regional transport) may vary under different meteorological conditions.

TECHNOLOGY TRANSFER

Need for Technology Transfer

In ROMNET, the use of the ROM to estimate effects of regional control strategies on ozone levels was demonstrated. Four reasons for using the ROM to assist in developing required ozone NAAQS attainment demonstrations are listed below.

1. The ROM data provide a means for ensuring consistency among States in the procedures used to derive transport assumptions in the design of urban strategies.
2. The ROM provides a means for simulating the combined effects from numerous urban areas across the region.
3. The ROM provides the most technically defensible way to estimate future ozone/precursor concentrations transported into urban areas.
4. The ROM provides data for use in SIPs that may be very difficult or expensive to obtain otherwise.

For reasons noted previously, using the ROM as the sole modeling tool to demonstrate attainment of the ozone NAAQS may not be the best approach. The UAM has been designated as the preferred method for attainment demonstrations. However, the ROM is most useful in conjunction with "nesting" the UAM within a ROM domain. In this approach, the ROM is used to provide initial and boundary conditions estimates, as well as other inputs, for UAM applications.

Although the concept of nesting is straightforward, its implementation is not. Part of the difficulty lies in managing the large quantity of data generated as part of ROM simulations, and in providing an easy means for States to access and retrieve selected data sets needed in UAM applications. Also, although ROM and UAM are both three-dimensional photochemical grid models, they are dissimilar in many aspects. For example, the horizontal and vertical structure and resolution of the two models differ. Also, the UAM preprocessors require input data formats that are unlike those used for ROM data sets. These technical problems have been overcome as part of ROMNET through the development of two computer systems. These are the GMISS and the ROM-UAM Interface.

Gridded Model Information Support System (GMISS)

GMISS contains an archive of ROM databases, as well as utilities for retrieving these data, and can be easily accessed by the States. The data types in GMISS include ROM-predicted pollutant concentrations, selected meteorological inputs to the ROM, biogenic emissions calculated for ROM simulations,

and topographic information. The UAM subsystem of GMISS is designed to provide all of the ROM data necessary to use the ROM-UAM Interface for developing UAM inputs. GMISS resides on the EPA IBM 3090 and is accessible by States from their local terminals via a user-friendly menu system. Data can be retrieved for user-specified dates and subregions of the ROM domain. Additional information on GMISS is provided in Section 6 of this report.

ROM-UAM Interface

The ROM-UAM Interface is a set of computer programs that convert ROM data files accessed from GMISS into input files used directly by the UAM and 4 of its 13 preprocessor programs. The Interface does not handle mixing heights or anthropogenic emissions, both of which must be supplied by the user. The Interface is sufficiently flexible to allow the user to substitute user-derived inputs (e.g., wind fields) for ROM data. Interface programs prescribe a series of algorithms that match and interpolate ROM data to the resolution used by UAM. The structure of the ROM-UAM Interface is described in greater detail in Section 6.

ACCOMPLISHMENTS OF THE ROMNET PROJECT

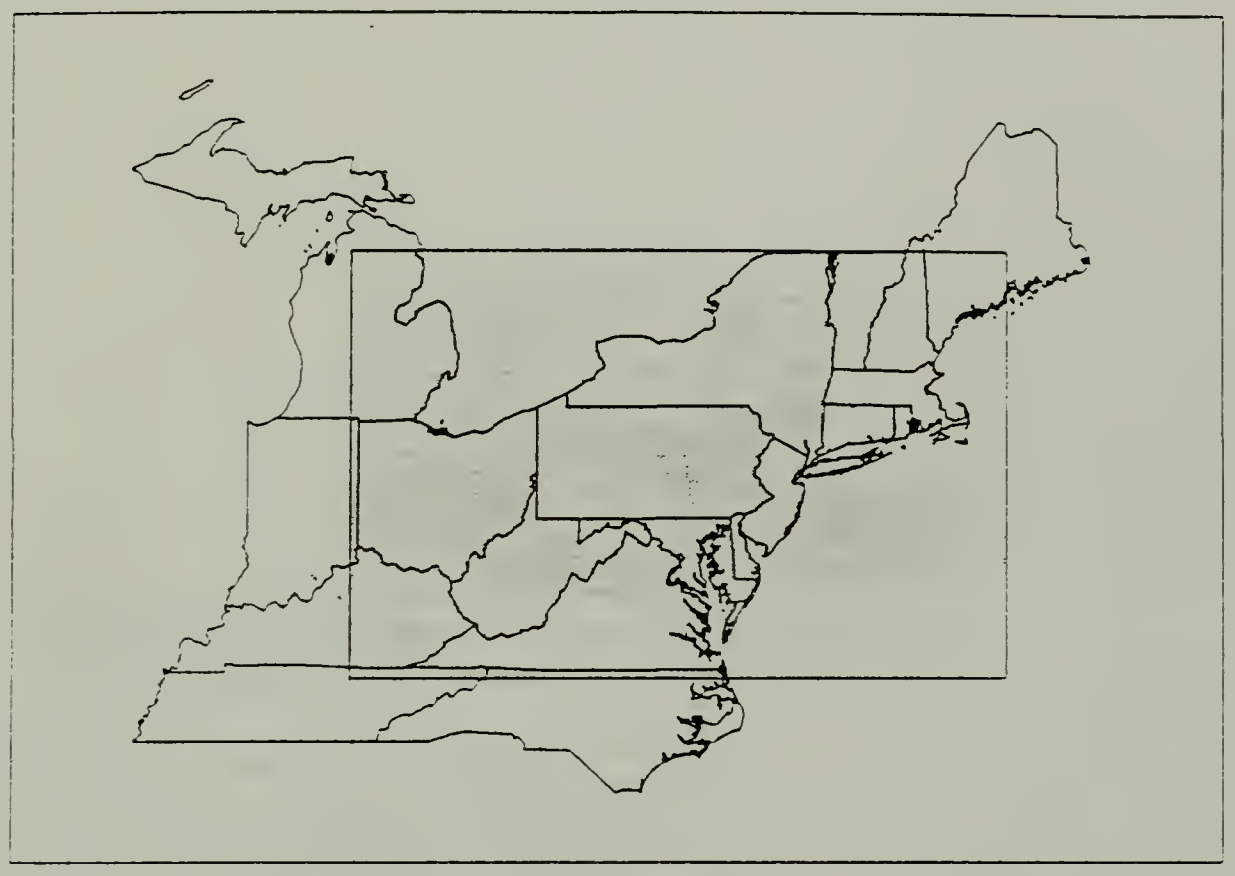
The ROMNET project was successful in achieving the goals set forth at its inception. This success was attained through the accomplishment of several major milestones.

First, ROMNET brought together numerous State/local agencies and EPA offices to focus their energies in a cooperative manner to address long-standing issues concerning problems of ozone transport in the Northeast. During ROMNET, State agency representatives played an active role along with the EPA in the management and technical decision-making aspects of the project. The organizational structure and communications process adopted in ROMNET may be useful as a framework for future joint efforts among States and the EPA.

Second, the ROM was demonstrated to be a practical tool for addressing policy-related issues concerning the efficacy of various regional control strategies. The ROMNET program has provided insights to Federal, State, and local policymakers on a number of such issues, including: (a) the relative effects of VOC and NO_x controls; (b) the role of transport into and within the Northeast Corridor; (c) the magnitude of controls potentially needed to reduce ozone to the level specified in the NAAQS; (d) the

usefulness of strategies that incorporate changes in the photochemical reactivity of VOC emissions; and (e) the effects of the large uncertainty in biogenic emissions on conclusions regarding the efficacy of control strategies.

Finally, as a result of ROMNET, computer systems and databases have been developed that will enable State agencies to quantitatively consider regional and interurban transport in preparing ozone SIPs. The infrastructure containing these systems gives States access to ROM databases and provides methodologies and guidance for using these data to support urban-level attainment demonstrations. These systems are generic in nature and can be used by States in other portions of the United States, where ROM simulations are planned as part of future EPA-State regional modeling projects.



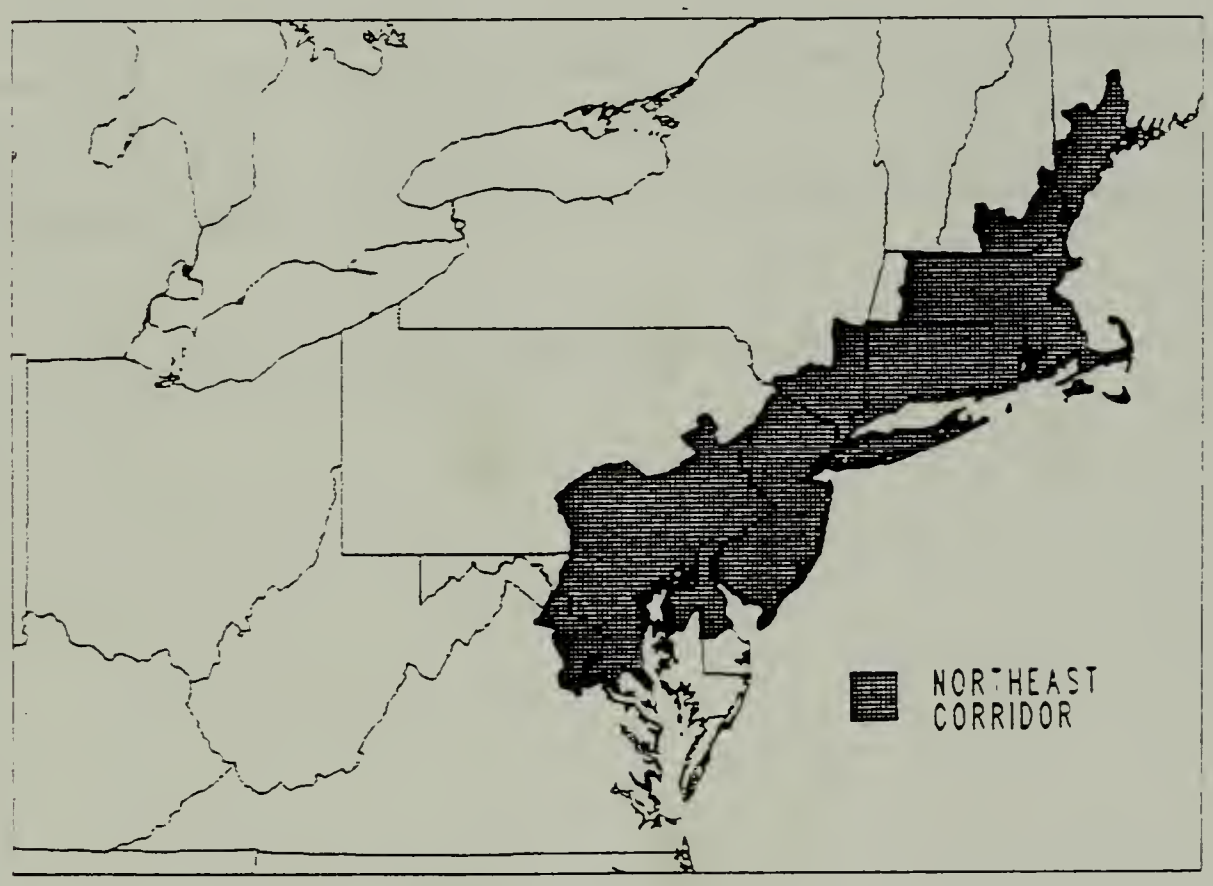


Figure ES-1. The ROMNET region.

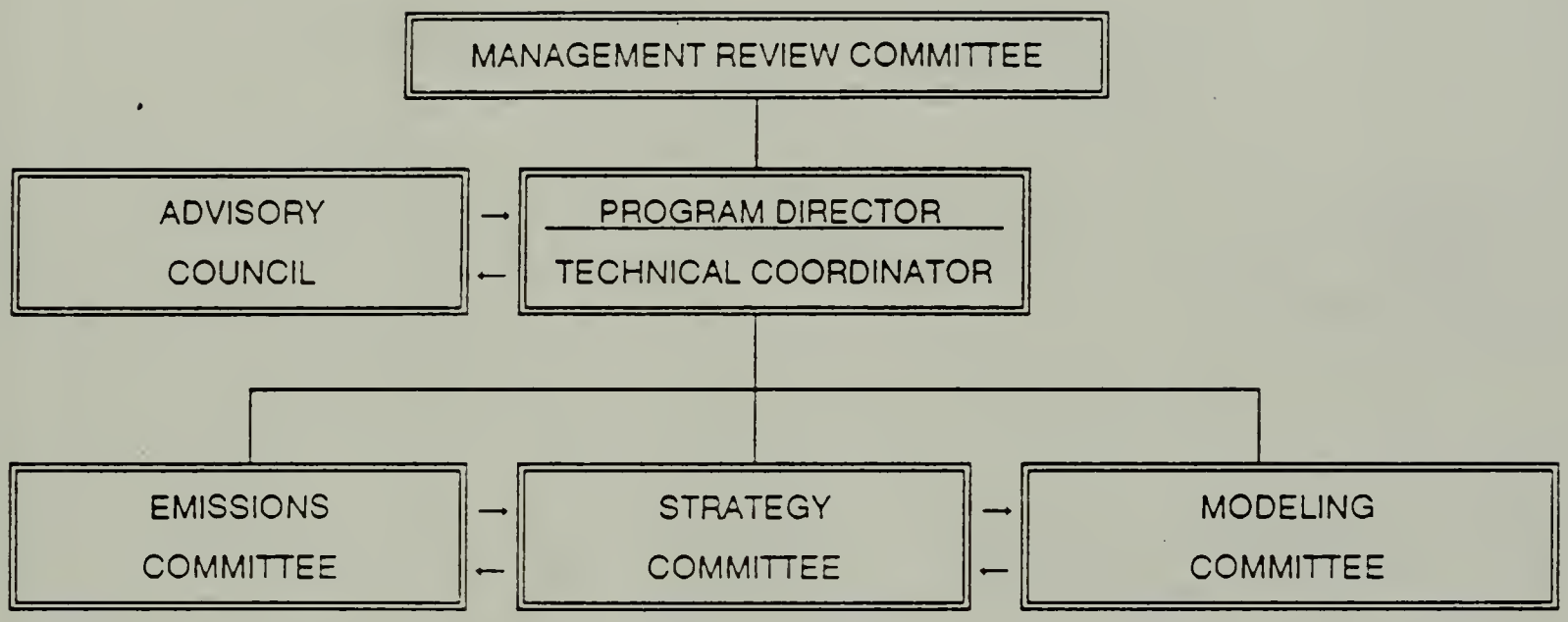


Figure ES-2. ROMNET management structure.

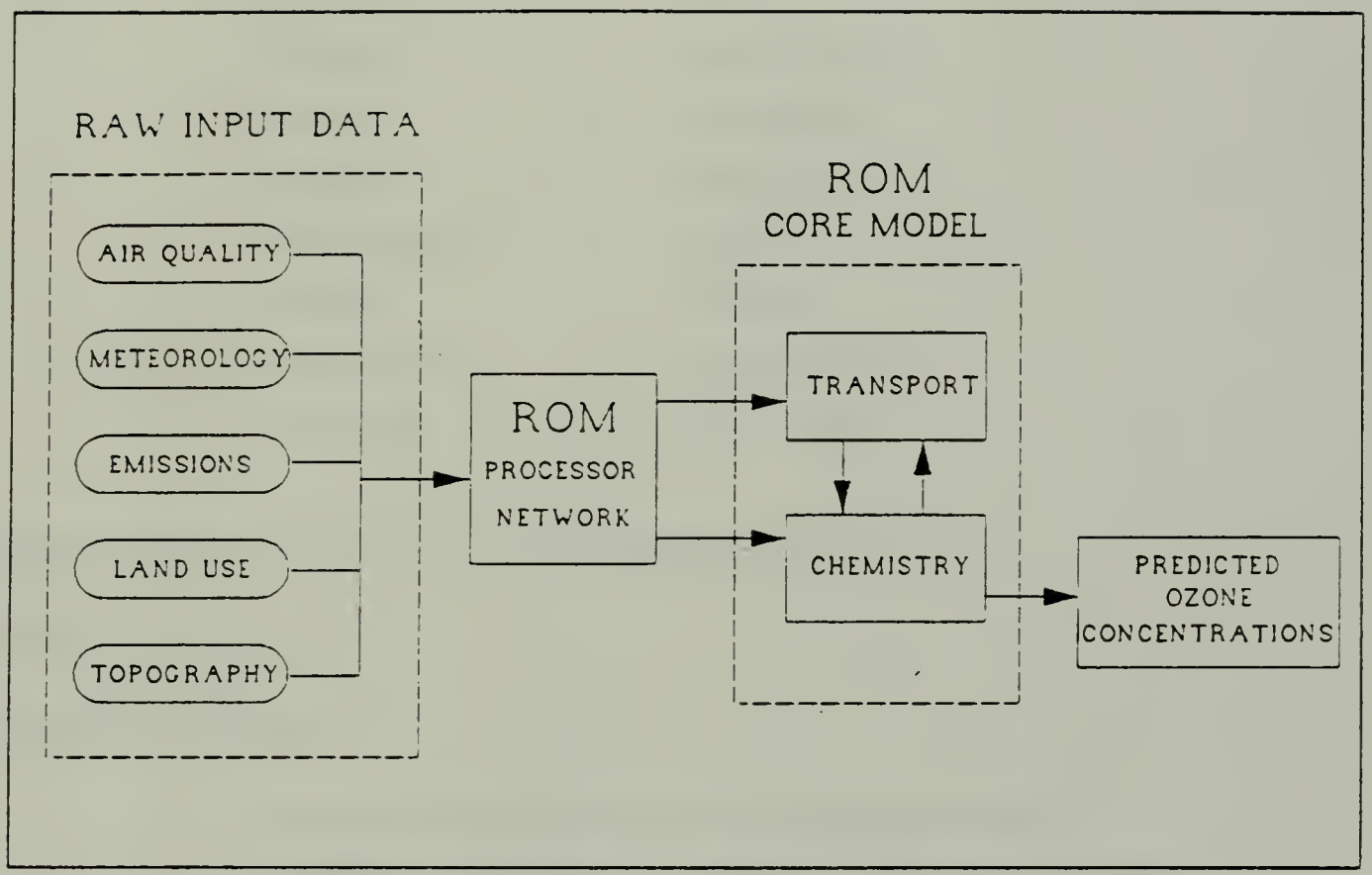


Figure ES-3. Components of the ROM.

TABLE ES-1. ORGANIZATIONS PARTICIPATING IN ROMNET

State/local air pollution control agencies:

Connecticut	New York
Delaware	Ohio
Kentucky	Pennsylvania
Maine	Philadelphia
Maryland	Rhode Island
Massachusetts	Vermont
Michigan	Virginia
New Hampshire	Washington, DC
New Jersey	West Virginia

Northeast States for Coordinated Air Use Management (NESCAUM)

EPA Regions I through V

EPA Headquarters Offices:

- Office of Air Quality Planning and Standards (OAQPS)
- Atmospheric Research and Exposure Assessment Lab (AREAL)
- Office of Policy Analysis and Review (OPAR)
- Office of Policy Planning and Evaluation (OPPE)
- Office of Mobile Sources (OMS)

Contractors:

- Computer Sciences Corporation (CSC)
- Alliance Technologies Corporation

TABLE ES-2. ROMNET CONTROL STRATEGIES

Control Strategy Number	Controls	Issue(s) Addressed	Rationale
CS01 (MOBILE 3.9)	Maximum technology VOC regionwide; NO_x at 2005 baseline levels	2, 3	Test effects of strategies emphasizing VOC reductions by comparison with 2005 baseline.
CS02 (MOBILE 3.9)	Maximum technology VOC in NE Corridor only; NO_x at 2005 baseline	2	Test effect of VOC controls outside Corridor on ozone in Corridor by comparison with CS01.
CS03 (MOBILE 3.9)	Maximum technology VOC in NE Corridor and in other nonattainment areas; only 2005 baseline elsewhere	2	Test effect of "rural" VOC controls outside Corridor on ozone Corridor by comparison with CS01 and CS02.
CS04	Not performed		
CS05	VOC and NO_x controls prescribed in HR3030 with October 1989 Waxman-Dingell tailpipe standards	3	Test effects of proposed Clean Air Act legislation.
CS06-CS09	CS01 and CS05 varying biogenic emissions by ± a factor of 3	5	Test sensitivity of conclusions to uncertainty in biogenics.
CS10	Enhanced maximum technology VOC and NO_x controls applied regionwide	1, 3	Test effects of VOC and NO_x controls.
CS11	Maximum technology NO_x; VOC at 2005 baseline	1, 3	Compare effects of NO_x controls with VOC and NO_x (CS10).
CS12	Maximum technology VOC; NO_x at 2005 baseline	1, 3	Compare effects of VOC controls with VOC and NO_x controls (CS10) and NO_x controls above.
CS13-CS14	Maximum technology VOC with NO_x point source controls (CS13) or NO_x mobile source controls (CS14)	1, 3	(CS11). Test whether it is appropriate to focus controls on certain NO_x source types.

continued

TABLE ES-2 (continued)

Control Strategy Number	Controls	Issue(s) Addressed	Rationale
CS15	Maximum technology VOC and NO_x controls but with methanol (M100) vehicles in the NE Corridor and low-reactivity solvent substitution regionwide	3, 4	Test implications of reducing reactivity.
CS16	CS10 controls plus across-the-board VOC reductions in New York City and Baltimore/Washington, DC. Also NO_x point source emissions at 2005 baseline in New York City	3	Reduce maximum ozone to < 125 ppb throughout the U.S. portion of the region.
CS17	Maximum technology NO_x controls (CS11) with "low" biogenics	5	Examine effectiveness of NO_X control within uncertainty range in biogenics.
CS18	CS15 with additional across-the-board VOC reductions in New York City and Baltimore/Washington, DC; also NO_x point source emissions at 2005 baseline in New York City	3	Test relative importance of reactivity reduction and VOC technology controls by comparison with CS12 and CS16.
CS19	CS18 but with NO_x point source emissions at 2005 baseline in Baltimore/Washington, DC	2, 3	Reduce maximum ozone to < 125 ppb throughout the U.S. portion of the region.
CS20	2005 baseline with methanol (M100) vehicles in NE Corridor and low-reactivity solvents regionwide	4	Compare effectiveness of reactivity reductions in base *vs.* post-control scenarios and with VOC technology controls.
CS21, CS22	Biogenics sensitivity tests with CS19 varying biogenic emissions by ± a factor of 3	5	Test effect of biogenic emissions uncertainty on a strategy that reduces ozone to < 125 ppb.

continued

TABLE ES-2 (concluded)

Control Strategy Number	Controls	Issue(s) Addressed	Rationale
CS23	CS19, but with more realistic "rule effectiveness" assumptions and vehicle fleet penetration estimates	3	Test sensitivity of results to limitations in control program effectiveness.
CS24	CS19 in NE Corridor; 2005 baseline elsewhere	2	Assess relative importance of transport from outside the Corridor *vs.* controls on emissions within the Corridor.
CS25	CS19 outside Corridor; 2005 baseline in NE Corridor	2	

APPENDIX B

Post-1996 Rate-of-Progress Plan:

1999 Target Emission Level Calculation
1999 Projected Emissions Inventory and Demonstration of Meeting the 1999 Milestone

8/17/94

Massachusetts 1999 Target Emission Level calculation
(all calculations in tons per summer day)

VOC

Step 1	Total Emissions Inventory	Eastern	Western	Total
	Point	46	10	56
	Area	338	54	392
	On Road	250	52	302
	Off Road	255	43	298
	Biogenic	374	277	651
	Total	1263	436	1699
Step 2	Rate of Progress Inventory	- Excludes biogenics and perchloroethylene emissions		
	Point	46	10	56
	Area	313	49	363
	On Road	250	52	302
	Off road	255	43	298
	Total	864	155	1019
Step 3	Adjusted Baseyear Inventory	- Using 1999 mobile EFs on 1990 VMT		
	Point	46	10	56
	Area	313	49	363
	On Road	177	37	214
	Off road	255	43	298
	Total	792	140	931
Step 4	Total reductions required			
	1996 Target Level of emissions	663	117	
	Percent reduction from VOC controls		0	
	% Reduction	0	0	0
	FMVCP Reduction (96-99)	5	2	7
	Total	5	2	7
Step 5	Target level of emissions	- 1990 Rate of Progress Inventory - total reductions required		
		658	115	774

NOx

	Total Emissions Inventory	Eastern	Western	Total
	Point	333	27	361
	Area	28	4	32
	On Road	320	67	387
	Off Road	159	17	176
	Biogenic	0	0	0
	Total	840	116	956
	Rate of Progress Inventory	- Excludes biogenics		
	Point	333	27	361
	Area	28	4	32
	On Road	320	67	387
	Off road	159	17	176
	Total	840	116	956
	Adjusted Baseyear Inventory	- Using 1999 mobile EFs on 1990 VMT		
	Point	333	27	361
	Area	28	4	32
	On Road	252	52	304
	Off road	159	17	176
	Total	773	101	874
	Total reductions required			
	Percent reduction from NOx controls		9	
	% Reduction	70	9	79
	FMVCP Reduction	68	15	83
	Total	137	24	161
	Target level of emissions	1990 Rate of Progress Inventory - total reductions required		
		703	92	795

	VOC Growth Factor	NOx Growt Factor	1990 VOC Emissions East	West	Total	1999 Uncontrolled VOC Emissions East	West	Total	1-(VOC Control Efficiency)	1999 Controlled VOC Emissio East	West	Total
Stationary Source Emissions												
1. Non-utility	1.038	1.038	44	10	54	46	10	56	0.79	36	8	44
2. Utility	1.201	1.201	2	0	2	2	0	3	1.00	2	0	3
Stationary Source TOTAL			46	10	56	48	10	58		38	8	47
Area Source Emissions												
Waste Treatment Emission:												
1.Publicly Owned Treatment Works (POTW)	1.038	1.038	2	2	4	2	2	4	1.00	2	2	4
2. Haz. Waste Treatment	1.038	1.038	9	1	10	9	1	10	1.00	9	1	10
3. MSW Landfill	1.067	1.067	8	2	10	8	2	10	1.00	8	2	10
Gasoline Distr.												
1. Tank Truck Unloading	1.188	1.188	8	2	10	9	2	12	1.00	9	2	12
2. Vehicle Refuel	1.188	1.188	In Mobile Source Section						1.00			
3. Underground Tank Breathing	1.188	1.188	3	0	4	4	1	4	1.00	4	1	4
4. Transit losses	1.188	1.188	1	0	1	1	0	1	1.00	1	0	1
5. Aircraft Refuel.	1.188	1.188	0	0	0	1	0	1	1.00	1	0	1
6. Petrol. Vessels	1.188	1.188	3	0	3	4		4	0.24	1		1
Stationary Source Solvent Evap.:												
1. Dry Cleaning	1.137	1.137							1.00			
2. Surface Cleaning	1.051	1.051	26	3	29	27	3	31	0.74	20	3	23
Non-Indust. Surface Coating:												
1. Arch. Coating	1.034	1.034	46	7	53	47	7	55	0.80	38	6	44
2. Auto Refinish.	1.231	1.231	23	4	27	28	4	33	0.60	17	3	20
3. Traffic Marking	1.034	1.034	5	1	6	5	1	6	0.40	2	0	2
Indust. Coating:												
1. Furniture	1.051	1.051	13	2	14	14	2	15	1.00	14	2	15
2. Metal Containers	1.034	1.034	12	2	14	12	2	15	1.00	12	2	15
3. Motor Vehicles New	1.000	1.000	25	1	26	25	1	26	1.00	25	1	26
4. Machin. & Equip.	1.000	1.000	10	1	11	10	1	11	1.00	10	1	11
5. Appliances	1.009	1.009	0	0	0	0	0	0	1.00	0	0	0
6. Other Transportation Equip.	1.112	1.112	1		1	1		1	1.00	1		1
7. Metal Sheet, Strip, Coil	1.009	1.009	6	2	7	6	2	7	1.00	6	2	7
8. Factory Finished Wood	1.123	1.123	5	1	6	6	1	7	1.00	6	1	7
9. Elect. Insulation	1.017	1.017	3	1	4	3	1	4	1.00	3	1	4
10. Other Product Coating	1.034	1.034	6	1	7	6	1	7	1.00	6	1	7
11. High Perf. Maintenance	1.034	1.034	8	1	9	8	1	10	1.00	8	1	10
12. Marine Coatings	1.112	1.112	1		1	1		1	1.00	1		1
13. Oth. Specity. Purpose Cngs	1.034	1.034	8	1	9	8	1	10	1.00	8	1	10
Graphic Arts:	1.034	1.034	10	2	12	10	2	12	1.00	10	2	12
Cutback & Emulsified Asphalt (comb	1.034	1.034	0	0	0	0	0	0	1.00	0	0	0
Comm./Consumer Solvent:	1.034	1.034	45	7	52	46	7	54	0.82	38	6	44
Pesticide Use	1.034	1.034	4	2	6	4	2	6	1.00	4	2	6
Misc. Emissions:												
1. Bakeries	1.034	1.034	5	1	6	5	1	6	1.00	5	1	6
2. Petroleum Spills	1.038	1.038	2	0	2	2	0	3	1.00	2	0	3
3. Asphalt Roofing	1.034	1.034	0	0	0	0	0	0	1.00	0	0	0
4. Leaking UST	1.038	1.038	0	0	0	0	0	0	1.00	0	0	0
5. Chemical Storage Tanks	1.038	1.038	6	0	7	7	0	7	1.00	7	0	7
Small Stationary Fuel Combustion:												
1. Residential 0.1653	1.034	1.034	0	0	0	0	0	0	1.00	0	0	0
2. Comm./Institutional 0.503	1.034	1.034	1	0	1	1	0	1	1.00	1	0	1
3. Industrial 0.3317	1.038	1.038	1	0	1	1	0	1	1.00	1	0	1
Forest Fires:	1.000	1.000	0	0	0	0	0	0	1.00	0	0	0
Solid Waste Incineration:												
1. Residential	1.034	1.034	0	0	0	0	0	0	1.00	0	0	0
2. Comm./Institutional	1.034	1.034	0	0	0	0	0	0	1.00	0	0	0
3. Industrial	1.038	1.038	0	0	0	0	0	0	1.00	0	0	0
Structural Fires	1.034	1.034	2	0	3	2	0	3	1.00	2	0	3
Food Preparation												
1. Backyard Grills	1.034	1.034	3	0	3	3	0	3	1.00	3	0	3
2. Commercial Charbroiling	1.034	1.034	1	0	1	1	0	2	1.00	1	0	2
Area Source TOTAL (minus perchloroethylene)			313	49	362	330	52	383		288	46	334
					362			383				334
Mobile Source Emissions												
On-Road Mobile (1996 EF)												
1. Urban	1.225	1.225										
2. Small Urban	1.324	1.324										
3. Rural	1.251	1.251										
4. Total	1.236	1.236	177	37	214	219	46	265	0.54	118	26	144
			(90VMT~99EF)			(99VMT~99EF - unc)				(99VMT~99EF - cntl)		
On road mobile source total			177	37	214	219	46	265		118	26	144
Off road Mobile Emissions												
Aircraft Operations:												
1. Logan	1.074	1.074	4		4	4		4	1.00	4		4
2. Others	1.143	1.143	1	0	2	1	0	2	1.00	1	0	2
Railroads:	1.000	1.000	0	0	1	0	0	1	1.00	0	0	1
Marine Vessels:												
1. Recreation (incl. in off-hghw	1.034	1.034							1.00			
2. Commercial	1.123	1.123	1		1	1		1	1.00	1		1
Off-Highway:												
Total off-highway emissions	1.034	1.034	249	42	292	258	44	302	0.89	229	39	268
1. Farm Equip.	1.179	1.179							1.00			
2. Construction Equip.	1.098	1.098							1.00			
3. Industrial Equip.	1.038	1.038							1.00			
4. Off-road Motorcycles	1.034	1.034							1.00			
5. Lawn & Garden	1.034	1.034							1.00			
6. Snowmobiles	1.034	1.034							1.00			
Off road mobile source total			255	43	298	264	44	309		235	39	275
					298			309				275
Mobile Source Emissions TOTAL			432	80	512	483	90	573		353	65	418
Total Massachusetts Emissions			791	140	930	861	153	1014		679	120	799
								Target Level of Emissions		658	115	774

	VOC Growth Factor	NOx Growt Factor	1990 NOx Emissions East	West	Total	1999 Uncontrolled NOx Emissions East	West	Total	1-(NOx Control Efficiency)	1999 Controlled NOx Emiss East	West	Total
Stationary Source Emissions												
1. Non-utility	1.038	1.038	56	7	64	58	8	66	0.86	50	7	56
2. Utility	1.201	1.201	277	20	297	333	24	357	0.59	195	14	209
Stationary Source TOTAL			333	27	361	391	32	423		245	21	265
Area Source Emissions												
Waste Treatment Emission:												
1.Publicly Owned Treatment Works (POTW)	1.038	1.038							1.00			
2. Haz. Waste Treatment	1.038	1.038							1.00			
3. MSW Landfill	1.067	1.067							1.00			
Gasoline Distr.												
1. Tank Truck Unloading	1.188	1.188							1.00			
2. Vehicle Refuel	1.188	1.188							1.00			
3. Underground Tank Breathing	1.188	1.188							1.00			
4. Transit losses	1.188	1.188							1.00			
5. Aircraft Refuel.	1.188	1.188							1.00			
6. Petrol. Vessels	1.188	1.188							1.00			
Stationary Source Solvent Evap.:												
1. Dry Cleaning	1.137	1.137							1.00			
2. Surface Cleaning	1.051	1.051							1.00			
Non-Indust. Surface Coating:												
1. Arch. Coating	1.034	1.034							1.00			
2. Auto Refinish.	1.231	1.231							1.00			
3. Traffic Marking	1.034	1.034							1.00			
Indust. Coating:												
1. Furniture	1.051	1.051							1.00			
2. Metal Containers	1.034	1.034							1.00			
3. Motor Vehicles New	1.000	1.000							1.00			
4. Machin. & Equip.	1.000	1.000							1.00			
5. Appliances	1.009	1.009							1.00			
6. Other Transportation Equip.	1.112	1.112							1.00			
7. Metal Sheet, Strip, Coil	1.009	1.009							1.00			
8. Factory Finished Wood	1.123	1.123							1.00			
9. Elect. Insulation	1.017	1.017							1.00			
10. Other Product Coating	1.034	1.034							1.00			
11. High Perf. Maintenance	1.034	1.034							1.00			
12. Marine Coatings	1.112	1.112							1.00			
13. Oth. Specity. Purpose Cings	1.034	1.034							1.00			
Graphic Arts:	1.034	1.034							1.00			
Cutback & Emulsified Asphalt (comb	1.034	1.034							1.00			
Comm./Consumer Solvent:	1.034	1.034							1.00			
Pesticide Use	1.034	1.034							1.00			
Misc. Emissions:												
1. Bakeries	1.034	1.034							1.00			
2. Petroleum Spills	1.038	1.038							1.00			
3. Asphalt Roofing	1.034	1.034							1.00			
4. Leaking UST	1.038	1.038							1.00			
5. Chemical Storage Tanks	1.038	1.038							1.00			
Small Stationary Fuel Combustion:									1.00			
1. Residential 0.1653	1.034	1.034	5	1	5	5	1	5	1.00	5	1	5
2. Comm./Institutional 0.503	1.034	1.034	14	2	16	14	2	17	1.00	14	2	17
3. Industrial 0.3317	1.038	1.038	9	1	11	10	1	11	1.00	10	1	11
Forest Fires:	1.000	1.000	0	0	0	0	0	0	1.00	0	0	0
Solid Waste Incineration:												
1. Residential	1.034	1.034							1.00			
2. Comm./Institutional	1.034	1.034							1.00			
3. Industrial	1.038	1.038							1.00			
Structural Fires	1.034	1.034	0	0	0	0	0	0	1.00	0	0	0
Food Preparation												
1. Backyard Grills	1.034	1.034							1.00			
2. Commercial Charbroiling	1.034	1.034							1.00			
Area Source TOTAL (minus perchloroethylene)			28	4	32	29	5	34		29	5	34
					32			34				34
Mobile Source Emissions												
On-Road Mobile (1996 EF)												
1. Urban	1.225	1.225										
2. Small Urban	1.324	1.324										
3. Rural	1.251	1.251										
4. Total	1.236	1.236	252	52	304	311	65	376	0.77	239	51	290
			(90VMT~99EF)			(99VMT~99E				(99VMT~99EF - cntl)		
On road mobile source total			252	52	304	311	65	376		239	51	290
Off road Mobile Emissions												
Aircraft Operations:												
1. Logan	1.074	1.074	5		5	6		6	1.00	6		6
2. Others	1.143	1.143	0	0	1	0	0	1	1.00	0	0	1
Railroads:	1.000	1.000	7	3	11	7	3	11	1.00	7	3	11
Marine Vessels:												
1. Recreation (incl. in off-hghw	1.034	1.034							1.00			
2. Commercial	1.123	1.123	6		6	7		7	1.00	7		7
Off-Highway:												
Total off-highway emissions	1.034	1.034	140	13	154	145	14	159	0.89	145	14	159
1. Farm Equip.	1.179	1.179							1.00			
2. Construction Equip.	1.098	1.098							1.00			
3. Industrial Equip.	1.038	1.038							1.00			
4. Off-road Motorcycles	1.034	1.034							1.00			
5. Lawn & Garden	1.034	1.034							1.00			
6. Snowmobiles	1.034	1.034							1.00			
Off road mobile source total			159	17	176	165	17	183		165	17	183
					176			183				
Mobile Source Emissions TOTAL			411	69	480	477	82	559		404	69	472
Total Massachusetts Emissions			773	101	874	897	118	1015		678	94	771
									Target Level of Emissions	703	92	795

APPENDIX C

Corrected Pages of the 1990 Base Year Emissions Inventories

I-7. EMISSIONS SUMMARY

The 1990 base year emissions were calculated in tons per summer day (TPSD) for VOC, NOx and CO. Emissions were also calculated in tons per winter day (TPWD) for CO.

Emissions were developed and presented for anthropogenic emissions comprising the following four broad categories: Stationary Point, Stationary Area, On-Road Mobile5a and Non-Road Mobile Sources. Biogenic emissions were developed and presented for the VOC summer day inventory. Emissions were developed and presented by county in Tables I-4 to I-22 and Figures I-9 to I-13. CO winter emissions by CO non-attainment cities and towns are presented in Table I-19 and Figure I-14.

In the statewide anthropogenic VOC inventory for a typical summer day, the source categories account for the following contributions: Stationary Point 5.4%, Stationary Area 37.4%, On-Road MOBILE5.a 28.8% and Non-Road Mobile 28.4%. The inclusion of Biogenic emissions changes to the following proportions: Stationary Point 3.3%, Stationary Area 23.1%, On-Road Mobile5a 17.8%, Non-Road Mobile 17.5% and Biogenics 38.3%. These proportions are presented in Table I-2 and Figures I-4 and I-5.

The following are the proportions of the source categories statewide for a typical summer day for NO_x: Stationary Point 37.7%, Stationary Area 3.4%, On-Road Mobile5a 40.5% and Non-Road Mobile 18.4%. NOx emissions for these categories are presented in Table I-2 and Figure I-6.

The following are the proportions of the source categories

TABLE I-2

SUMMARY MASSACHUSETTS 1990 BASE YEAR EMISSION INVENTORIES
VOLATILE ORGANIC COMPOUNDS, NITROGEN OXIDES AND CARBON MONOXIDE (TONS PER SUMMER AND WINTER DAY)

Revised Aug 19 1994 (Petro vessel)
4suminv90

VOLATILE ORGANIC COMPOUNDS (VOC)

	TONS PER SUMMER DAY (TPSD)	%	ANTHROPOGENIC (NO BIOGENICS) TONS PER SUMMER DAY (TPSD)	%
1 STATIONARY POINT	56.34	3.31%	56.34	5.37%
2 STATIONARY AREA	391.88	23.05%	391.88	37.37%
3 ON-ROAD MOBILE5.a	302.22	17.78%	302.22	28.82%
4 NON-ROAD MOBILE	298.14	17.54%	298.14	28.43%
5 BIOGENICS	651.24	38.31%		
TOTAL	1699.82		1048.58	

NITROGEN OXIDES (NOx)

	TONS PER SUMMER DAY (TPSD)	%
1 STATIONARY POINT	360.63	37.71%
2 STATIONARY AREA	32.49	3.40%
3 ON-ROAD MOBILE5.a	386.93	40.46%
4 NON-ROAD MOBILE	176.18	18.42%
TOTAL	956.23	

CARBON MONOXIDE (CO)

	TONS PER SUMMER DAY (TPSD)	%	TONS PER WINTER DAY (TPWD)	%
1 STATIONARY POINT	32.77	0.88%	32.77	0.77%
2 STATIONARY AREA	53.44	1.44%	711.95	16.78%
3 ON-ROAD MOBILE5.a	2268.26	61.15%	3387.69	79.87%
4 NON-ROAD MOBILE	1354.68	36.52%	109.36	2.58%
TOTAL	3709.15		4241.77	

TABLE I-3

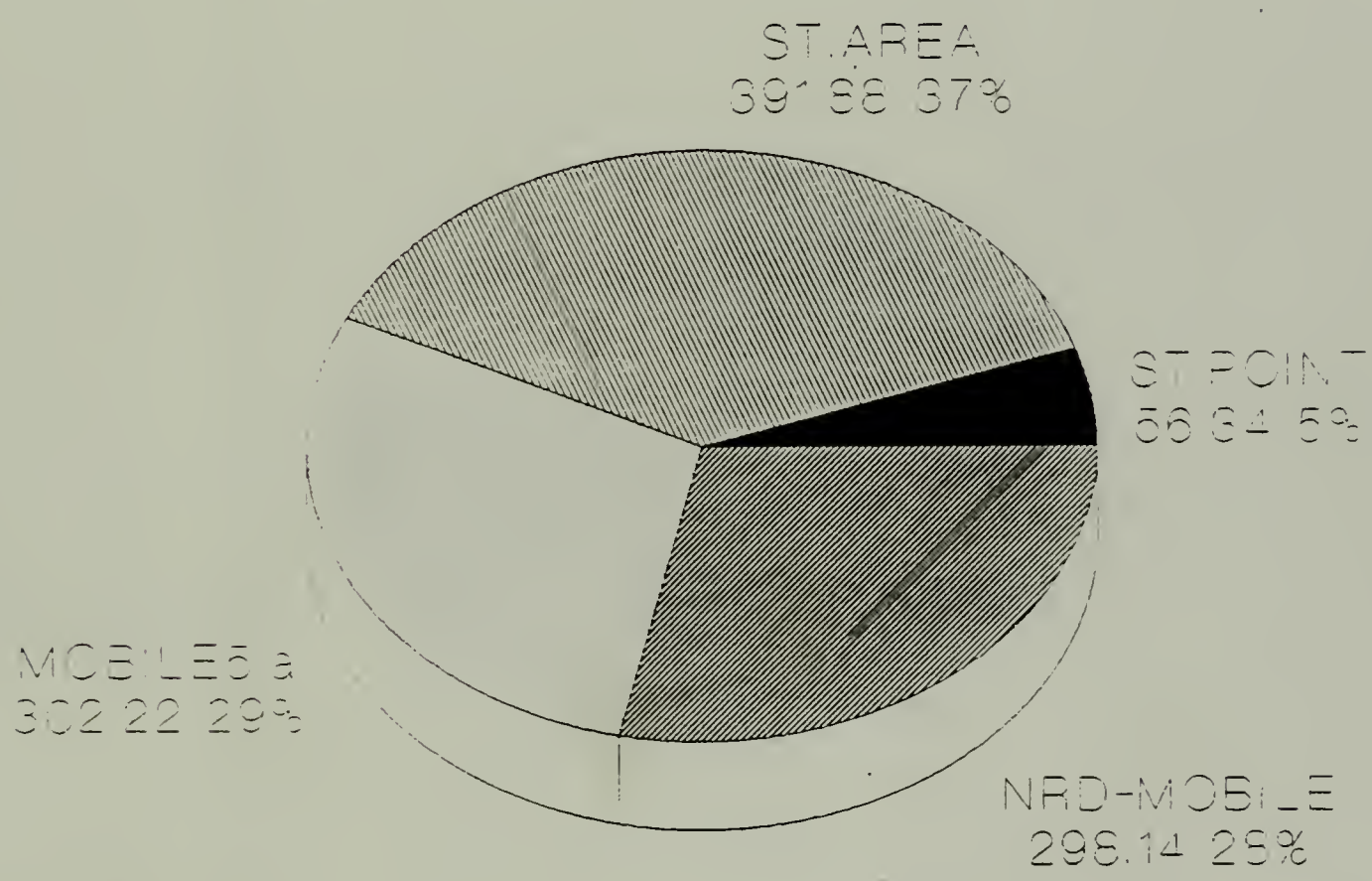
SUMMARY MASSACHUSETTS 1990 BASE YEAR EMISSION INVENTORIES
VOC, NOX AND CO TONS PER SUMMER DAY
FOR BOSTON AND SPRINGFIELD OZONE NON-ATTAINMENT AREAS

Revised Aug 19 94 (Petro vessel)
sumNAA90b6

ANTHROPOGENIC	BOSTON NON-ATTAINMENT AREA TONS SUMMER DAY	SPRINGFIELD NON-ATTAINMENT AREA TONS SUMMER DAY	STATE TOTAL
VOC			
1 STATIONARY POINT	46.682	9.660	56.342
2 STATIONARY AREA	338.187	53.694	391.881
3 ON-ROAD MOBILE5.a	249.769	52.452	302.221
4 NON-ROAD MOBILE	255.182	42.953	298.135
TOTAL ANTHROPOGENIC	889.820	158.759	1048.579
	84.9%	15.1%	
VOC WITH BIOGENICS			
1 STATIONARY POINT	46.682	9.660	56.342
2 STATIONARY AREA	338.187	53.694	391.881
3 ON-ROAD MOBILE5.a	249.769	52.452	302.221
4 NON-ROAD MOBILE	255.182	42.953	298.135
5 BIOGENICS	374.020	277.220	651.24
TOTAL VOC	1263.840	435.979	1699.819
	74.4%	25.6%	
NITROGEN OXIDES (NOx)			
1 STATIONARY POINT	333.266	27.369	360.635
2 STATIONARY AREA	28.092	4.396	32.488
3 ON-ROAD MOBILE5.a	319.681	67.253	386.934
4 NON-ROAD MOBILE	156.278	19.904	176.182
TOTAL	837.317	118.922	956.239
	87.6%	12.4%	
CARBON MONOXIDE (CO)			
1 STATIONARY POINT	26.942	5.824	32.766
2 STATIONARY AREA	45.508	7.927	53.435
3 ON-ROAD MOBILE5.a	1886.622	381.639	2268.261
4 NON-ROAD MOBILE	1176.459	178.218	1354.677
TOTAL	3135.531	573.608	3709.139
	84.5%	15.5%	

FIGURE I-4

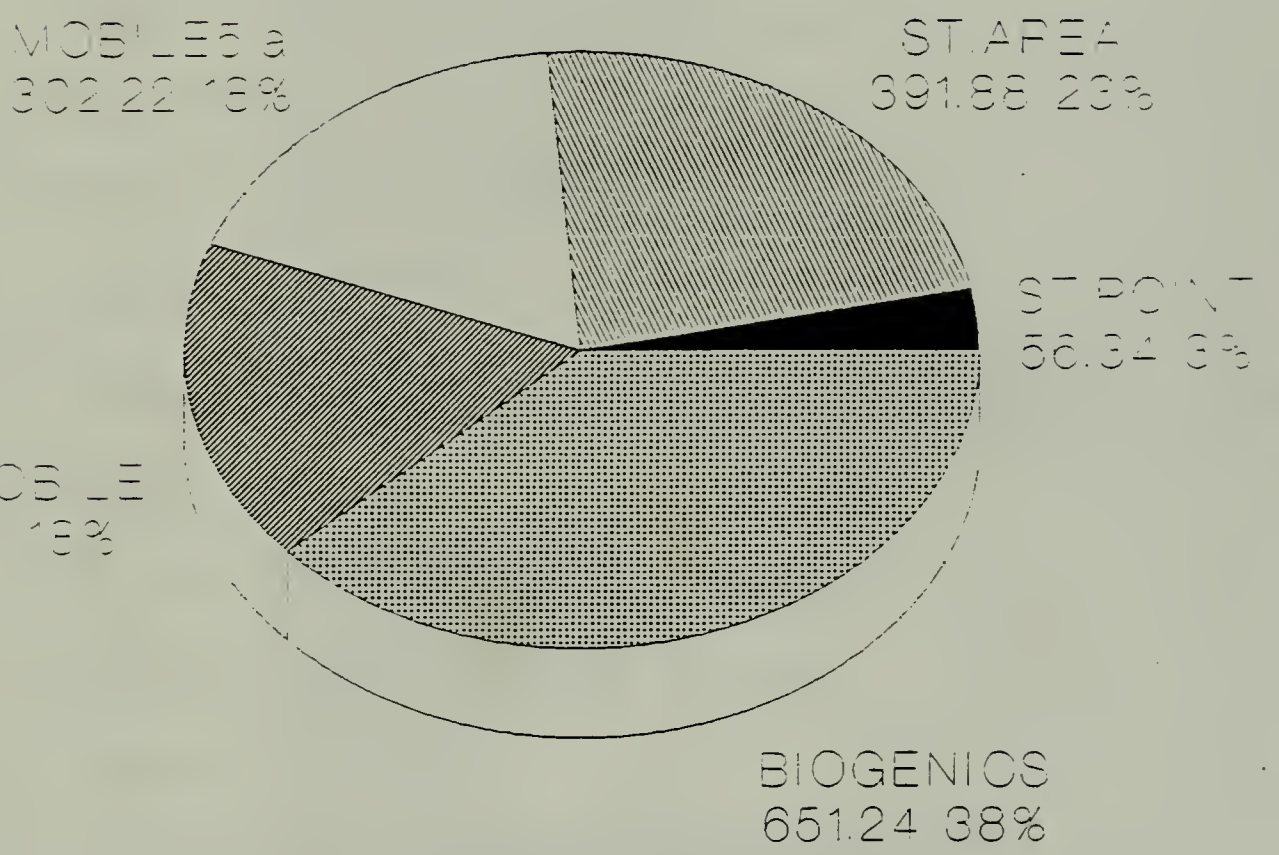
VOC ANTHROPOGENIC EMISSIONS 1990
TONS PER SUMMER DAY



ST.POINT,ST.AREA,MOBILE-5,NON-RD

FIGURE I-5

VOC EMISSIONS WITH BIOGENICS 1990
TONS PER SUMMER DAY

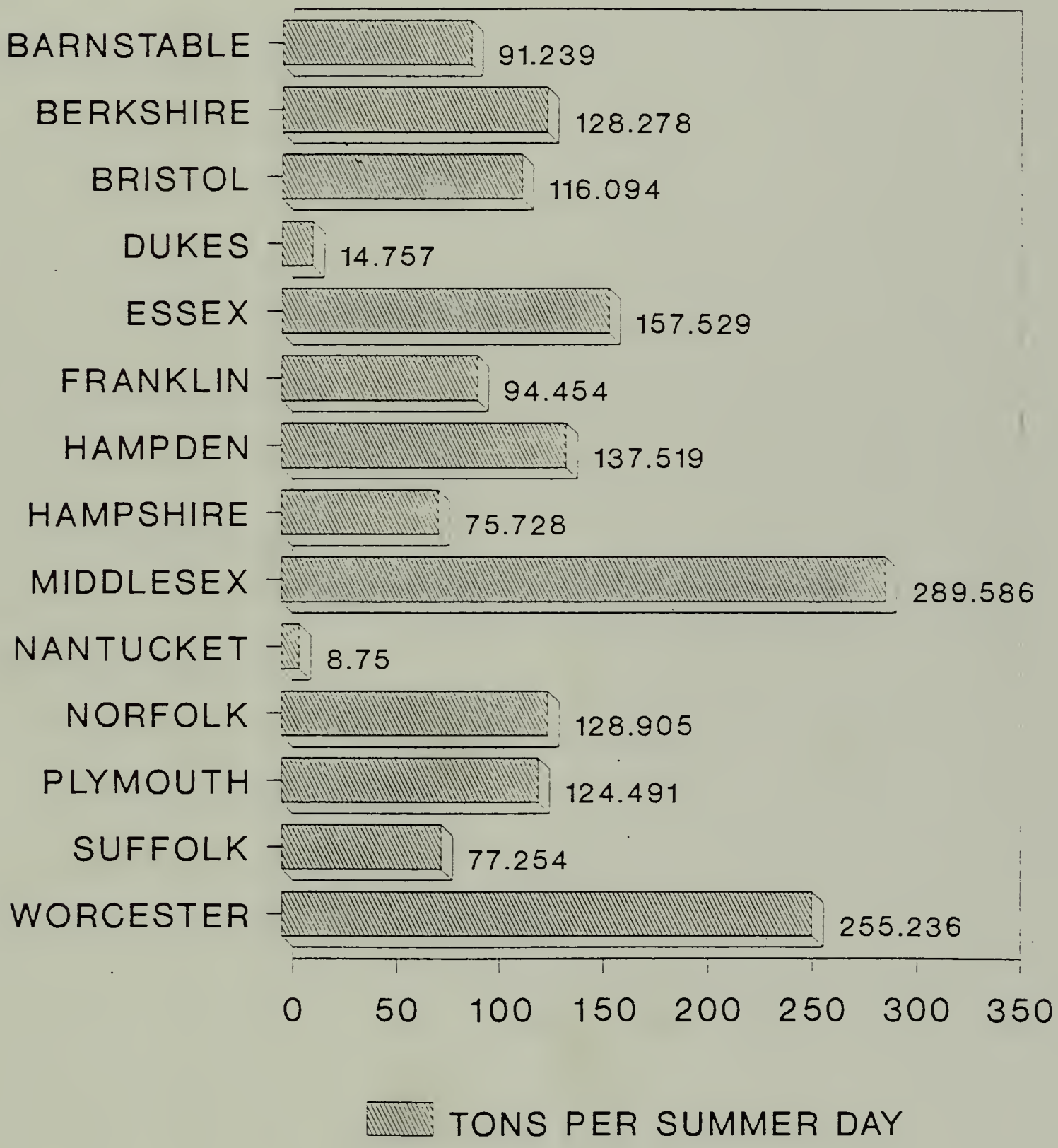


ALL CATEGORIES INCLUDING BIOGENICS

5

FIGURE I-8

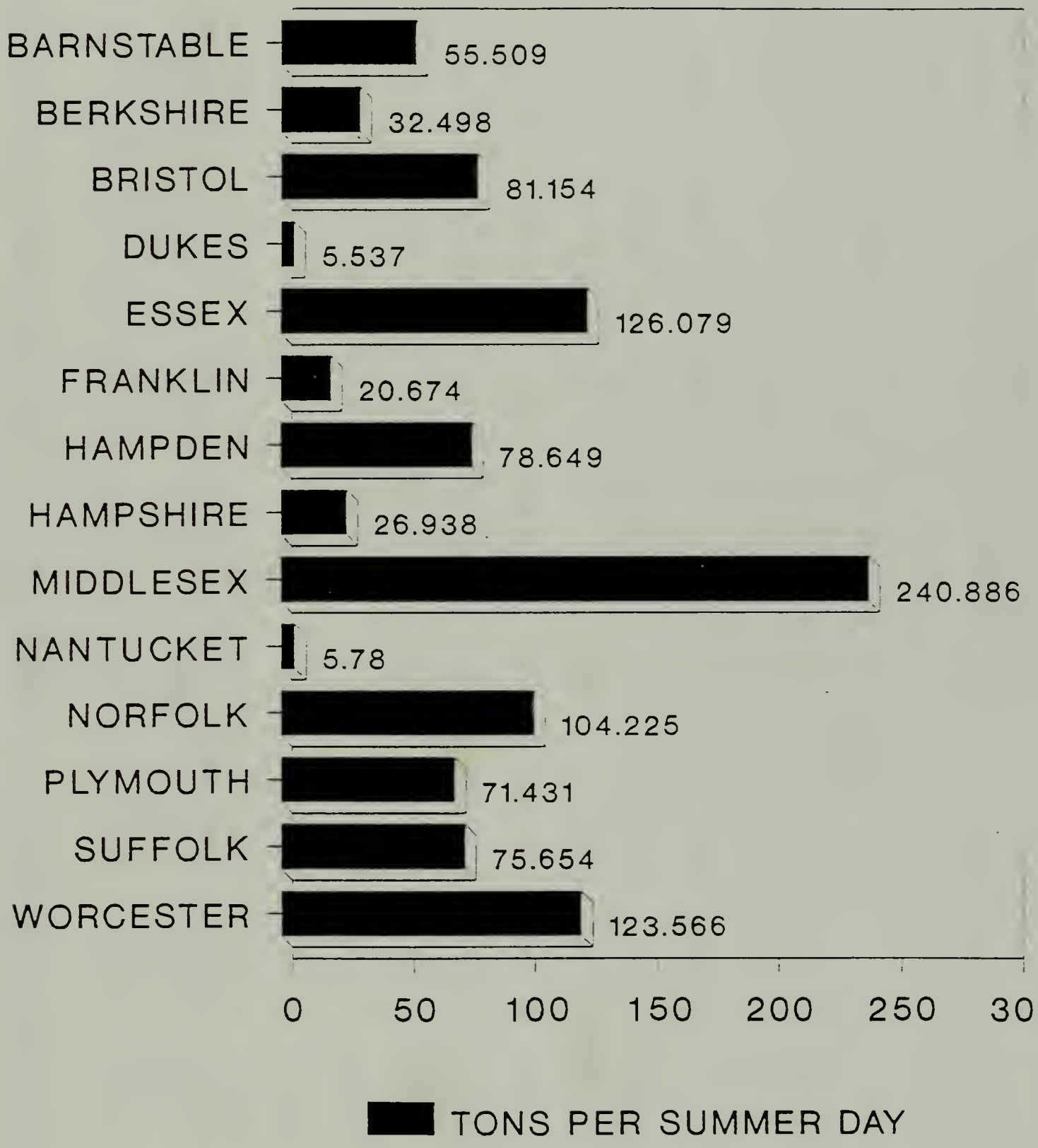
VOC WITH BIOGENICS EMISSIONS 1990
TONS PER SUMMER DAY



BY COUNTIES

FIGURE I-9

VOC ANTHROPOGENIC EMISSIONS 1990
TONS PER SUMMER DAY



nox90

BY COUNTIES

TABLE I-5

August 19 94 rev petro vessel

STATIONARY AREA SOURCE VOC EMISSIONS 1990 TONS PER YEAR (TPY) AND SUMMER DAY (TPSD)

3areacty COUNT	1 WASTE MGT TPY	1 WASTE MGT TPSD	2 GASOL DIST TPY	2 GASOL DIST TPSD	3 SOLVENT EVAP TPY	3 SOLVENT EVAP TPSD	4 FUEL COM & FIRES TPY	4 FUEL COM & FIRES TPSD	TOTAL STATIONARY AREA EMIS VOC TPY	TOTAL STATIONARY AREA EMIS VOC TPSD
1 BARNS	138.84	0.383	157.24	0.511	2227.26	7.669	636.09	0.528	3159.43	9.091
2 BERKS	367.57	1.184	255.84	0.857	2578.43	9.052	473.08	0.292	3674.92	11.385
3 BRIST	676.95	2.003	491.73	1.571	7373.59	25.330	1607.37	0.850	10149.64	29.754
4 DUKES	11.94	0.033	15.81	0.051	148.89	0.515	59.36	0.060	236.00	0.659
5 ESSEX	2742.76	8.911	464.93	1.512	12129.06	42.700	2066.98	1.004	17403.73	54.127
6 FRANK	120.45	0.387	51.97	0.170	1358.06	4.835	231.01	0.121	1761.49	5.513
7 HAMPD	805.89	2.608	316.13	1.029	6631.53	23.023	1472.78	0.797	9226.33	27.457
8 HAMPS	246.30	0.752	96.09	0.313	2334.85	8.048	477.76	0.226	3155.00	9.339
9 MIDDL	701.42	2.059	965.24	3.141	27314.02	94.266	4113.80	1.717	33094.48	101.183
10 NANTU	8.27	0.023	9.03	0.029	121.40	0.389	39.37	0.042	178.07	0.483
11 NORFO	500.10	1.411	540.80	1.737	9633.11	32.762	1869.21	0.902	12543.22	36.812
12 PLYMO	470.15	1.337	312.14	1.016	5809.64	20.110	1346.71	0.716	7938.64	23.179
13 SUFFO	11.01	0.030	1316.78	4.030	8687.86	29.531	2144.39	1.167	12160.04	34.758
14 WORCE	628.76	1.903	500.46	1.627	12496.77	43.622	2136.87	0.989	15762.86	48.141
STATE	7430.41	23.024	5494.19	17.594	98844.47	341.85	18674.78	9.411	130443.85	391.881
								qc	130443.85	391.881

TABLE I-16

ALL SOURCE CATEGORIES VOC 1990 TONS PER YEAR AND SUMMER DAY BY COUNTY

Aug 19 94 rev.petro vess 4voccat90

	COUNTY	POINT TPY	POINT TPSD	ST.AREA TPY	ST.AREA TPSD	MOBILE5.a ON-ROAD TPSD	TOTAL NON-ROAD TPSD	BIOGENIC TPSD	TOTAL ANTHROPO--GENIC VOC TPSD	TOTAL VOC WITH BIOGENIC TPSD
1	BARNSTABLE	172	0.551	3159.43	9.091	9.826	36.041	35.73	55.509	91.239
2	BERKSHIRE	333	1.067	3674.92	11.385	11.831	8.215	95.78	32.498	128.278
3	BRISTOL	2314	7.417	10149.64	29.754	25.452	18.531	34.94	81.154	116.094
4	DUKES	0	0.000	236.00	0.659	0.609	4.269	9.22	5.537	14.757
5	ESSEX	2105	6.747	17403.73	54.127	34.548	30.657	31.45	126.079	157.529
6	FRANLIN	97	0.311	1761.49	5.513	7.722	7.128	73.78	20.674	94.454
7	HAMPDEN	2448	7.846	9226.33	27.457	23.329	20.017	58.87	78.649	137.519
8	HAMPSHIRE	136	0.436	3155.00	9.339	9.570	7.593	48.79	26.938	75.728
9	MIDDLESEX	4129	13.234	33094.48	101.183	66.525	59.944	48.70	240.886	289.586
10	NANTUCKET	37	0.119	178.07	0.483	0.282	4.896	2.97	5.780	8.750
11	NORFOLK	1153	3.696	12543.22	36.812	36.113	27.604	24.68	104.225	128.905
12	PLYMOUTH	484	1.551	7938.64	23.179	20.670	26.031	53.06	71.431	124.491
13	SUFFOLK	1873	6.003	12160.04	34.758	16.555	18.338	1.60	75.654	77.254
14	WORCESTER	2298	7.365	15762.86	48.141	39.189	28.871	131.67	123.566	255.236
	STATE	17579	56.343	130443.85	391.881	302.221	298.135	651.24	1048.580	1699.820

TABLE I-20

ALL SOURCE CATEGORIES VOC 1990 TONS PER YEAR AND SUMMER DAY BY NON-ATTAINMENT AREAS

Aug 19 94 (petro vess)
6vocNAA90

	COUNTY	POINT TPY	POINT TPSD	ST.AREA TPY	ST.AREA TPSD	MOBILE5.a ON-ROAD TPSD	TOTAL NON-ROAD TPSD	BIOGENIC TPSD	TOTAL ANTHROPO--GENIC VOC TPSD	TOTAL VOC WITH BIOGENIC TPSD
BOSTON NON-ATTAINMENT AREA										
1	BARNSTABLE	172	0.551	3159.43	9.091	9.826	36.041	35.73	55.509	91.239
3	BRISTOL	2314	7.417	10149.64	29.754	25.452	18.531	34.94	81.154	116.094
4	DUKES	0	0.000	236.00	0.659	0.609	4.269	9.22	5.537	14.757
5	ESSEX	2105	6.747	17403.74	54.127	34.548	30.657	31.45	126.079	157.529
9	MIDDLESEX	4129	13.234	33094.48	101.183	66.525	59.944	48.70	240.886	289.586
10	NANTUCKET	37	0.119	178.07	0.483	0.282	4.896	2.97	5.780	8.750
11	NORFOLK	1153	3.696	12543.22	36.812	36.113	27.604	24.68	104.225	128.905
12	PLYMOUTH	484	1.551	7938.64	23.179	20.670	26.031	53.06	71.431	124.491
13	SUFFOLK	1873	6.003	12160.04	34.758	16.555	18.338	1.60	75.654	77.254
14	WORCESTER	2298	7.365	15762.86	48.141	39.189	28.871	131.67	123.566	255.236
BOSTON N.A.		14565	46.682	112626.12	338.187	249.769	255.182	374.02	889.821	1263.841
SPRINGFIELD NON-ATTAINMENT AREA										
2	BERKSHIRE	333	1.067	3674.92	11.385	11.831	8.215	95.78	32.498	128.278
6	FRANLIN	97	0.311	1761.49	5.513	7.722	7.128	73.78	20.674	94.454
7	HAMPDEN	2448	7.846	9226.33	27.457	23.329	20.017	58.87	78.649	137.519
8	HAMPSHIRE	136	0.436	3155.00	9.339	9.570	7.593	48.79	26.938	75.728
SPRINGFLD NA		3014	9.6602	17817.74	53.694	52.452	42.953	277.22	158.759	435.979
STATE		17579	56.342	130443.86	391.881	302.221	298.135	651.24	1048.580	1699.820

AMS input. Logan's activity factor would be adjusted to reflect Massport's emissions for Logan Airport.

B.2-vi PETROLEUM VESSEL LOADING AND UNLOADING

Evaporative VOC emissions from ocean going ships and barges carrying petroleum liquids result from loading and unloading losses, ballasting losses and transit losses. Loading losses according to Volume 1[7] are the primary source of evaporative emissions from marine vessel operations. Loading loss does not fully apply to Massachusetts because of the absence of refineries hence most gasoline vessel losses would be involved in the unloading of ships and barges. However , according to the Army Corps of Engineers, Waterborne Commerce[16], there is a small amount of shipment and outbound movement of gasoline from some ports in Massachusetts. EPA AP-42 does not give an emission factor for petroleum unloading but for ballasting of ships which is associated with unloading.

Ballasting VOC emissions are generated from the empty cargo tanks when the vapors are displaced to the atmosphere as the unloaded cargo tank is loaded with sea water in order to improve the stability of the empty ship. In addition, evaporative VOC emissions also occur offshore while the cargo is in transit, similar to breathing losses associated with petroleum storage.

The data for the amount of fuel unloaded from vessels from each port in the state was obtained from the 1990 Waterborne Commerce of the United States.[16] The New England Section of this report presented freight traffic for each port in short tons for the following petroleum

//

fuels: gasoline, jet fuel, kerosene, distillate oil, residual oil and naphtha. Crude oil and other petroleum products were reported in the 1989 Waterborne Commerce, but not for 1990.

The petroleum freight in short tons were converted to gallons using the product density of each fuel given in AP-42 Table 4.3-2. The conversion factor in AP-42 is given in pounds per gallons and the inverse of this conversion factor was used to convert from short tons to pounds to gallons as presented in Table B.2-12. Appropriate emission factors for the fuels are also presented in this table.

The following is the procedure for estimating 1990 VOC emissions for gasoline vessel unloading for Weymouth Harbor (Norfolk County) as presented in Table B.2-11:

656,000 tons gasoline X 2,000 lbs. X 1/5.6 density gal/lb X

EF 0.8 lb/10^3 gal /2,000 lbs. = 74.97 tons VOC

The emissions for the state amounted to 1067.37 tons in 1990 as shown in Table B.2-11.

The 1990 VOC emissions were then adjusted for a typical summer day as presented in the last column of Table B.2-11. Monthly fuel sales of kerosene, residual and distillate oil and motor gasoline for the state were obtained from Tables 47 to 49 of the 1990 Petroleum Marketing Annual[3] and presented in Table B.2-13. The summer adjustment factor for gasoline was calculated at 1.111.

In order to facilitate AIRS AMS data entry under one scc category, a composite emission factor was developed as shown in Table B.2-14.

TABLE B.2-11

PETROLEUM VESSEL UNLOADING/BALLASTING VOC EMISSIONS 1990

portvoc1
August 17 94

PORT	CNTY	PORT RECEIPTS GASOL TONS	BALLASTING GASOLINE DEN.17857 GAL/LB =GALS *.8 0.8LB/TG VOC TONS	GASOLINE SHIPMENTS & OUTBOUND (LOADING) 1.8LB/TGL VOC TONS	TOTAL GASOLINE BALLAST & LOADING VOC TONS	KEROSINE DEN.14286 GAL/LB = GALS .005LB/T KEROSENE TONS	DIST OIL DEN.14085 GAL/LB = GALS .005LB/TG DIS OIL VOC TONS	RES OIL DEN.1266 GAL/LB = GALS .0004LB RES OIL TONS	NAPHTA DEN.1563 GAL/LB = GALS 0.5LB/TG NAPHTA VOC TONS	NON GASOLINE TOTAL VOC TONS	TOTAL VOC EM COUNTY 1990 TPY	TOTAL VOC EM COUNTY 1990 TPSD /365 *1.111
SALEM H	ESSX	0	0.00	0	0.00	0	0.00	66000	0.05	539000	0.00	0	0.00			
GLOUCESTR	ESSX	0	0.00	0	0.00	0	0.00	6000	0.004	0	0.00	0	0.00			
	TOT		0.00		0.00	0.00		0.00		0.05		0.00		0.00	0.053	0.053	0.0002
MAIN WFRONT	SUFF	1772000	202.51	32000	10 29	212.80	484000	0.35	2010000	1.42	1631000	0.01	0	0.00			
CHELSEA H	SUFF	3668000	419.20	253000	81.32	500.52	233000	0.17	2087000	1.47	792000	0.00	0	0.00			
MYSTIC R	SUFF	829000	94.74	20000	6.43	101.17	63000	0.05	540000	0.38	700000	0.00	2000	0.16			
TOWN RIV	SUFF	0	0.00	0	0.00	0.00	0	0.00	53000	0.04	0	0.00	0	0.00			
	TOT		716.45		98.03	814.49		0.56		3.30		0.02		0.16	4.032	818.519	2.4914
WEYMOUTH	NORF	656000	74.97	106000	34.07	109 04	36000	0.03	464000	0.33	42000	0.00	0	0.00	0.353	109.395	0.3330
C.COD CNL	BARN		THRU														
WOODS HOL	BARN		THRU														
PROVINCETWN	BARN	5000	0.57	0	0.00	0.57	2000	0.001									
	TOT		0.57		0.00			0.00		0.00		0.00		0.00	0.000	0.571	0.0017
N.BEDF/FH	BRIS	0	0.00	5000	1.61	1 61	0	0.00	128000	0.09	122000	0.00	0	0.00			
FALL RIV	BRIS	1147000	131.08	3000	0.96	132.05	9000	0.01	218000	0.15	519	0.00	0	0.00			
	TOT		131.08		2.57	133.66		0.01		0.24		0.00		0.00	0.251	133.907	0.4076
VINEYARD	DUKE	26000	2.97	1000	0.32	3 29	0	0.00	21000	0.01	0	0.00	0	0.00	0.015	3.308	0.0101
NANT SOUND	THRU																
REFUGE H	NANT	14000	1.60	0	0.00	1.60	0	0.00	34000	0.02	0	0 00	0	0.00			
			1.60		0.00	1.60		0 00		0.02		0.00		0.00	0.024	1.624	0 0049
		8117000		420000			827000		5627000								
1990	STATE		927.65		135.00	1062.65		0.59		3 96		0.02		0 16	4.728	1067.376	3.2489
																1067.376	3.2489

TABLE B.2-14

vessunld3
Aug 19 94

PETROLEUM VESSEL UNLOADING/BALLASTING AND LOADING
VOC EMISSIONS 1990 - FOR AIRS-AMS DATA ENTRY
FROM TABLE B.2-11 USING COMPOSITE EMISSION FACTOR

SCC : 25-05-020-000

STATEWIDE ACTIVITY — PETROLEUM 3,048,904 — 8,537,000 SHORT TONS TH.GALLS (*.1529)/2000

COUNTY ACTIVITY LEVEL :

	COUNTIES	VOC EMISS	%	ANNUAL ACTIVITY TH.GALLS	OZ PO ACTIV /365*92 * 1.111	VOC TPY EM.FAC 0.70017LB/TGL	VOC PO TPSD /92
1	BARNSTABLE	0.57	0.1%	1628	456	0.57	0.002
2	BERKSHIRE	0	0.0%	0	0	0.00	0.000
3	BRISTOL	133.91	12.5%	382509	107115	133.91	0.408
4	DUKES	3.31	0.3%	9455	2648	3.31	0.010
5	ESSEX	0.05	0.0%	143	40	0.05	0.000
6	FRANKLIN	0	0.0%	0	0	0.00	0.000
7	HAMPDEN	0	0.0%	0	0	0.00	0.000
8	HAMPSHIRE	0	0.0%	0	0	0.00	0.000
9	MIDDLESEX	0	0.0%	0	0	0.00	0.000
10	NANTUCKET	1.62	0.2%	4627	1296	1.62	0.005
11	NORFOLK	109.39	10.2%	312469	87501	109.39	0.333
12	PLYMOUTH		0.0%	0	0	0.00	0.000
13	SUFFOLK	818.52	76.7%	2338073	654737	818.52	2.491
14	WORCESTER		0.0%	0	0	0.00	0.000
	STATE	1067.37	100.0%	3048904	853793	1067.38	3.249

ACTIVITY LEVEL UNITS : THOUSAND GALLONS PETROLEUM
ACTIVITY LEVEL PROCESS : TRANSFERRED OR THRUPUT
ACTIVITY LEVEL METHOD :

PEAK OZ DAYS/WEEK : 7
PEAK OZ WEEKS/YEAR : 52 PO THRUPUT : 28.003 %

EMISSION FACTORS : VOC: 0.70017 (COMPOSITE)
EMISSION FACTOR UNITS : LB/TH.GAL AP-42 T.4.3-2, ASTM

RULE EFFECTIVENESS : N/A TAKEN FROM:
RULE PENETRATION : N/A BALLAST: 0.8 LB/K.GAL
SIP RULE : NO & LOADING: 1.8 LB/K.GAL
FROM TABLE B.2-11

PO INTERVAL : 1 HR
WEEKDAY: 1.0 SAT : 1 SUN : 1

COMMENTS: SUMMER JUNE-AUGUST (TABLE C.4 MOBILE SECTION)
1 GALL = 6.54 LB, 1 LB = .1529 GAL AP-42 T.4.3-2 AV.DENSITY

13a.

TABLE B.2-15

GASOLINE DISTRIBUTION VOC EMISSIONS 1990 TONS PER YEAR AND SUMMER DAY
BY COUNTIES

august 19 94
gassum3

COUN	STAGE 1 TANK TR TPY	STAGE 1 TANK TR TPSD	UNDER TANK BREATH TPY	UNDER TANK BREATH TPSD	TRANST LOSS TPY	TRANS LOSS TPSD	%	AIRCR REFUEL TPY	AIRCR REFUEL TPSD	PETRO VESSL U TPY	PETRO VESSEL TPSD	TOTAL GASOL DIST TPY	TOTAL GASOL DIST TPSD
BARN	101.95	0.348	46.04	0.133	6.89	0.023	5.	1.79	0.005	0.57	0.002	157.24	0.511
BERK	221.08	0.754	29.44	0.085	4.41	0.015	0.	0.91	0.003	0.00	0.000	255.84	0.857
BRIS	234.12	0.798	105.73	0.306	15.82	0.054	1.	2.15	0.006	133.91	0.408	491.73	1.571
DUKE	7.82	0.027	3.53	0.010	0.53	0.002	0.	0.62	0.002	3.31	0.010	15.81	0.051
ESSE	304.49	1.038	137.51	0.397	20.57	0.070	1.	2.31	0.006	0.05	0.000	464.93	1.512
FRAN	34.21	0.117	15.45	0.045	2.31	0.008	0	0.00	0.000	0.00	0.000	51.97	0.170
HAMP	207.21	0.707	93.58	0.270	14.00	0.048	4.	1.34	0.004	0.00	0.000	316.13	1.029
HAMP	63.12	0.215	28.51	0.082	4.27	0.015	0.	0.19	0.001	0.00	0.000	96.09	0.313
MIDD	633.50	2.160	286.10	0.827	42.81	0.146	2.	2.83	0.008	0.00	0.000	965.24	3.141
NANT	4.48	0.015	2.02	0.006	0.30	0.001	1.	0.61	0.002	1.62	0.005	9.03	0.029
NORF	283.16	0.966	127.88	0.370	19.13	0.065	0.	1.24	0.003	109.39	0.333	540.80	1.737
PLYM	204.62	0.698	92.41	0.267	13.83	0.047	0	1.28	0.004	0.00	0.000	312.14	1.016
SUFF	222.66	0.759	100.55	0.291	15.05	0.051	78	160.00	0.438	818.52	2.491	1316.78	4.030
WORC	327.05	1.115	147.70	0.427	22.10	0.075	2.	3.61	0.010	0.00	0.000	500.46	1.627
STAT	2849.47	9.717	1216.45	3.516	182.02	0.620	99	178.88	0.49	1067.37	3.249	5494.19	17.594

REFERENCES FOR GASOLINE DISTRIBUTION

1. 21987 Census of Retail Trade, Geographic Area Series, Massachusetts Bureau of Census, U.S. Department of Washington DC. July 1989.

2. Department of Energy, Energy Information Administration, "State Energy Data Report - Consumption Estimates, 1960-1989". Washington DC April 1989.

3. Department of Energy, Energy Information Administration, "Petroleum Marketing Annual and 1990" Energy Information Administration, Office of Oil and Gas, U.S. Department of Energy, Washington DC. Decewmber 1991.

4. U.S. Department of Transportation, Federal Highway Administration, "Highway Statistics 1989 and 1990. FHWA-A-PL-91-003, Washington DC, October 1991.

5. "AP-42 Compilation of Air Pollutant Emission Factors" Volume 1. Stationary Point and Area Sources. 4th Ed. OAQPS RTP. NC. September 1985, Supplement A October 1986, Suppliement B September 1988. Supplement C September 1990, and Supplement D September 1991.

6. "Procedures for Estimating and Applying Rule Effectiveness in Post -1987 Base Year Emission Inventories for Ozone and Carbon Monoxide State Implementation Plans." OAQPS, Policy Development Section. RTP NC. June 1989.

7. "Procedures for the Preparation of Emission Inventories for Precursors of Ozone." Volume 1: General Guidance for Stationary Sources. EPA. 450/4-91-016 OAQPS RTP NC, May 1991.

8. Massachusetts Air Pollution Control Regulations. 310 CMR 7.02-7.18. 1987.

9. Request letter from Kenneth Santlal MA DEP to Jack Frangiamoni MA Department of Revenue for State Gasoline Sales for 1990, September 24, 1991.

10. Massachusetts DEP, Division of Air Quality Control. "Stage II Gasoline Vapor Recovery Program." Background Information and Technical Support Document for Public Hearings on the Proposed Amendments to 310 CMR 7.00 Regulatory Authority MGL c.111 Section 142A-142E, January 1989.

11. "Massachusetts 1982 State Implementation Plan for Ozone and Carbon Monoxide," and Appendix. Massachusetts DEQE Division of Air Quality Control, August 1982.

12. Telephone interviews with DEP Regional office, Springfield, MA and major gasoline distributors in Berkshire County:
Robert Vachula - DEP Springfield, Lee Cook - Mobile Oil Corp., Albany, NY, Dennis Kotch - Lipton Gas, Berkshire - Frank Sible, Charles Shogrin - O'Connel Gas.

13. Passenger Cars and Trucks Registration Counts, MLS-4 by Make and Model for the State of Massachusetts as of July 1, 1990. Statistical Services Division, R.L. Polk & Co.

14. American Society for Testing and Materials (ASTM), Philadelphia, PA Telephone interview with Dolores Collyer, March 2, 1992.

15. "FAA Air Traffic Activity FY 1990", US Department of Transportation, Federal Aviation Administration, Office of Management Systems, Washington, DC, July 1991.

16. "Waterborne Commerce of the United States, 1990, Part 1, Waterways and Harbors of the Atlantic Coast. Department of the Army Corps of Engineers, Water Resource Support Center, WRSC-WCUS-89-1, New Orleans, LA, June 1991.

17. EPA Memorandum on Emission Inventory Questions and Answers for AIRS\AMS Training Sessions, Region I July 1992, September 22 1992.

18. EPA Comments on 1990 Draft Emission Inventories, September 1 1992.

Name: GASDIST

APPENDIX D

1996 Adjustments:

Revised 1996 Target Emission Level Calculation
Revised 1996 Projected Emissions Inventory

Massachusetts Revised 1996 Target Emission Level Calculation

8/17/94 (all calculations in tons of VOC per summer day)

Step 1	Total Emissions Inventory	Western	Eastern	Total
	Point	10	46	56
	Area	54	338	392
	On Road	52	250	302
	Off Road	43	255	298
	Biogenic	277	374	651
	Total	436	1263	1699
Step 2	Rate of Progress Inventory	- Excludes biogenics and perchloroethylene emissions		
	Point	10	46	56
	Area	49	313	363
	On Road	52	250	302
	Off road	43	255	298
	Total	155	864	1019
Step 3	Adjusted Baseycar Inventory	- Using 1996 mobile EFs on 1990 VMT		
	Point	10	46	56
	Area	49	313	363
	On Road	39	182	221
	Off road	43	255	298
	Total	141	797	938
Step 4	Total reductions required			
	15% Reduction	21	119	141
	FMVCP Reductio	13	68	81
	RACT Corrections	1	7	8
	I/M Corrections	1	7	9
	Total	38	201	239
Step 5	Target level of emissions	- 1990 Rate of Progress Inventory - total reductions required		
		117	663	780

08/17/94 Revised 1996 Projected Emission Inventory

	Growth Factor	1990 VOC Emissions East	West	Total	1996 Uncontrolled VOC Emissions East	West	Total	1-(Control Efficiency)	1996 Controlled VOC Emiss East	West	Total
Waste Treatment Emission											
1.Publicly Owned Treatment Works (POTW)	1.016	2	2	4	2	2	4	1.00	2	2	4
2. Haz. Waste Treatment	1.016	9	1	10	9	1	10	1.00	9	1	10
3. MSW Landfill	1.121	8	2	10	9	2	11	1.00	9	2	11
Gasoline Distr.											
1. Tank Truck Unloading	1.113	8	2	10	9	2	11	1.00	9	2	11
2. Vehicle Refuel	1.113	In Mobile Source Section			0	0	0	1.00	0	0	0
3. Underground Tank Breathing	1.113	3	0	4	3	1	4	1.00	3	1	4
4. Transit losses	1.113	1	0	1	1	0	1	1.00	1	0	1
5. Aircraft Refuel	1.113	0	0	0	1	0	1	1.00	1	0	1
6 Petrol Vessels	1.113	3	0	3	4	0	4	0.24	1	0	1
Stationary Source Solvent Evap											
1 Dry Cleaning	1.09	0		0	0	0	0	1.00	0	0	0
2 Surface Cleaning	1.10	25	3	28	26	3	30	0.74	19	2	22
Non-Indust Surface Coating											
1. Arch. Coating	1.027	46	7	53	47	7	55	0.80	38	6	44
2. Auto Refinish	1.155	23	4	27	27	4	31	0.60	16	2	18
3. Traffic Marking	1.027	5	1	6	5	1	6	0.40	2	0	2
Indust. Coating											
1. Furniture	1.029	13	2	14	13	2	15	1.00	13	2	15
2. Metal Containers	1.027	12	2	14	12	2	14	1.00	12	2	14
3. Motor Vehicles New	1.000	25	1	26	25	1	26	1.00	25	1	26
4. Machin & Equip	1.000	10	1	11	10	1	11	1.00	10	1	11
5 Appliances	1.002	0	0	0	0	0	0	1.00	0	0	0
6 Other Transportation Equip	1.072	1	0	1	1	0	1	1.00	1	0	1
7 Metal Sheet, Strip, Coil	1.017	6	2	7	6	2	7	1.00	6	2	7
8 Factory Finished Wood	1.08	5		6	5	1	7	1.00	5	1	7
9 Elect Insulation	1.007	3	1	4	3	1	4	1.00	3	1	4
10. Other Product Coating	1.027	6	1	7	6	1	7	1.00	6	1	7
11. High Perf Maintenance	1.027	8	1	9	8	1	10	1.00	8	1	10
12 Marine Coatings	1.071	1	0	1	1	0	1	1.00	1	0	1
13 Oth Specity Purpose Ctngs	1.027	8	1	9	8	1	10	1.00	8	1	10
Graphic Arts.	1.027	10	2	12	10	2	12	1.00	10	2	12
Cutback & Emulsified Asphalt (com'b)	1.027	0	0	0	0	0	0	1.00	0	0	0
Comm./Consumer Solvent	1.027	45	7	52	46	7	53	0.82	38	6	44
Pesticide Use	1.027	4	2	6	4	2	6	1.00	4	2	6
Misc Emissions											
1. Bakeries	1.022	5	1	6	5	1	6	1.00	5	1	6
2 Petroleum Spills	1.016	2	0	2	2	0	2	1.00	2	0	2
3. Asphalt Roofing	1.022	0	0	0	0	0	0	1.00	0	0	0
4 Leaking UST	1.016	0	0	0	0	0	0	1.00	0	0	0
5. Chemical Storage Tanks	1.016	6	1	7	6	0	7	1.00	6	0	7
Small Stationary Fuel Combustion	1.[illegible]	2	0	2	2	0	2	1.00	2	0	2
Forest Fires	1.0[illegible]	0	0	0	0	0	0	1.00	0	0	0
Solid Waste Incineration 86											
1. Residential	1.022	0	0	0	0	0	0	1.00	0	0	0
2 Comm./Institutional	1.022	0	0	0	0	0	0	1.00	0	0	0
3 Industrial	1			0	0	0	0	1.00	0	0	0
Structural Fires	1.[illegible]	2		3	2	0	3	1.00	2	0	3
Food Preparation											
1 Backyard Grills	1.[illegible]	3		3	3	0	3	1.00	3	0	3
2 Commercial Charbroiling	1.022		0	1	1	0	2	1.00	1	0	2
Area Source Sum (minus perchloroethylene		317	45	362	325	52	376		284	46	329
On-Road Mobile (1996 EF)											
1. Urban	1.118			0	0	0	0		0	0	0
2 Small Urban	1.206			0	0	0	0		0	0	0
3. Rural	1.[illegible]			0	0	0	0		0	0	0
4 Total	1.18	185	38	223	215	46	260	0.53	125	27	152
		(96VMT*96EF)			(96VMT*96EF - unc)				(96VMT*96EF - cntl)		
On road mobile source sum		185	38	221	215	46	260		125	27	152
Aircraft Operations					0	0					
1. Logan	1.022	5	0	5	5	0	5	1.00	5	0	5
2. Others	1.063	0	0	1	0	0	1	1.00	0	0	1
Railroads	0.879	0	0	1	0	0	1	1.00	0	0	1
Marine Vessels											
1. Recreation (incl. in off-highway)	1.022			0	0	0	0	1.00	0	0	0
2. Commercial	1.078	1	0	1	1	0	1	1.00	1	0	1
Off-Highway											
Total off-highway emissions	1.022	248	42	292	255	43	298	0.89	226	39	265
1. Farm Equip	1.107			0	0	0	0	1.00	0	0	0
2 Construction Equip	1.0[illegible]			0	0	0	0	1.00	0	0	0
3. Industrial Equip	1.016			0	0	0	0	1.00	0	0	0
4. Off-road Motorcycles	1.022			0	0	0	0	1.00	0	0	0
5. Lawn & Garden	1.022			0	0	0	0	1.00	0	0	0
6. Snowmobiles	1.022			0	0	0	0	1.00	0	0	0
Off road mobile source sum		256	43	299	261	44	305		233	39	272
TOTAL		[illegible]	131	882	801	141	942		642	112	753
Stationary Sources	1.01[illegible]	46	10	56	47	10	57	0.79	37	8	45
		[illegible]	141	938	847	151	999		679	120	798

10/28/94

Massachusetts 1999 Target Emission Level calculation
(all calculations in tons per summer day)

withEPA offroad and RVP 9.0

VOC

Step 1	Total Emissions Inventory	Eastern	Western	Total
	Point	46	10	56
	Area	338	54	392
	On Road	250	52	302
	Off Road	178	30	208
	Biogenic	374	277	651
	Total	1186	423	1609
Step 2	Rate of Progress Inventory	- Excludes biogenics and perchloroethylene emissions		
	Point	46	10	56
	Area	313	49	363
	On Road	250	52	302
	Off road	178	30	208
	Total	787	142	929
Step 3	Adjusted Baseyear Inventory	- Using 1999 mobile EFs on 1990 VMT		
	Point	46	10	56
	Area	313	49	363
	On Road	190	40	230
	Off road	178	30	208
	Total	728	129	857
Step 4	Total reductions required			
	1996 Target Level of emissions	663	117	
	Percent reduction from VOC controls		0	
	% Reduction	0	0	0
	FMVCP Reduction (96-99)	7	2	9
	Total	7	2	9
Step 5	Target level of emissions	- 1990 Rate of Progress Inventory - total reductions required		
		603	107	710

NOx

	Total Emissions Inventory	Eastern	Western	Total
	Point	333	27	361
	Area	28	4	32
	On Road	320	67	387
	Off Road	157	20	177
	Biogenic	0	0	0
	Total	838	119	957
	Rate of Progress Inventory	- Excludes biogenics		
	Point	333	27	361
	Area	28	4	32
	On Road	320	67	387
	Off road	157	20	177
	Total	838	119	957
	Adjusted Baseyear Inventory	- Using 1999 mobile EFs on 1990 VMT		
	Point	333	27	361
	Area	28	4	32
	On Road	253	53	306
	Off road	157	20	177
	Total	771	104	876
	Total reductions required			
	Percent reduction from NOx controls		9	
	% Reduction	69	9	79
	FMVCP Reduction	66	15	81
	Total	136	24	160
	Target level of emissions	1990 Rate of Progress Inventory - total reductions required		
		702	95	797

	VOC Growth Factor	NOx Growth Factor	1990 VOC Emissions East	West	Total	1999 Uncontrolled VOC Emissions East	West	Total	1-(VOC Control Efficiency)	1999 Controlled VOC Emissi East	West	Total
Stationary Source Emissions												
1. Non-utility	1.038	1.038	44	10	54	46	10	56	0.79	36	8	44
2. Utility	1.201	1.201	2	0	2	2	0	3	1.00	2	0	3
Stationary Source TOTAL			46	10	56	48	10	58		38	8	47
Area Source Emissions												
Waste Treatment Emission:												
1. Publicly Owned Treatment Works (POTW)	1.038	1.038	2	2	4	2	2	4	1.00	2	2	4
2. Haz. Waste Treatment	1.038	1.038	9	1	10	9	1	10	1.00	9	1	10
3. MSW Landfill	1.067	1.067	8	2	10	8	2	10	1.00	8	2	10
Gasoline Distr.												
1. Tank Truck Unloading	1.188	1.188	8	2	10	9	2	12	1.00	9	2	12
2. Vehicle Refuel	1.188	1.188	In Mobile Source Section						1.00			
3. Underground Tank Breathing	1.188	1.188	3	0	4	4	1	4	1.00	4	1	4
4. Transit losses	1.188	1.188	1	0	1	1	0	1	1.00	1	0	1
5. Aircraft Refuel.	1.188	1.188	0	0	0	1	0	1	1.00	1	0	1
6. Petrol. Vessels	1.188	1.188	3	0	3	4		4	0.24	1		1
Stationary Source Solvent Evap.:												
1. Dry Cleaning	1.137	1.137							1.00			
2. Surface Cleaning	1.051	1.051	26	3	29	27	3	31	1.00	27	3	31
Non-Indust. Surface Coating:												
1. Arch. Coating	1.034	1.034	46	7	53	47	7	55	0 80	38	6	44
2. Auto Refinish.	1.231	1 231	23	4	27	28	4	33	0.60	17	3	20
3. Traffic Marking	1.034	1.034	5	1	6	5	1	6	0 40	2	0	2
Indust. Coating:												
1. Furniture	1.051	1 051	13	2	14	14	2	15	1 00	14	2	15
2. Metal Containers	1 034	1.034	12	2	14	12	2	15	1 00	12	2	15
3. Motor Vehicles New	1.000	1.000	25	1	26	25	1	26	1.00	25	1	26
4. Machin. & Equip.	1.000	1.000	10	1	11	10	1	11	1.00	10	1	11
5. Appliances	1.009	1 009	0	0	0	0	0	0	1 00	0	0	0
6. Other Transportation Equip	1.112	1.112	1		1	1		1	1 00	1		1
7. Metal Sheet, Strip, Coil	1.009	1 009	6	2	7	6	2	7	1.00	6	2	7
8. Factory Finished Wood	1.123	1.123	5	1	6	6	1	7	1.00	6	1	7
9. Elect. Insulation	1.017	1.017	3	1	4	3	1	4	1.00	3	1	4
10. Other Product Coating	1.034	1.034	6	1	7	6	1	7	1.00	6	1	7
11. High Perf. Maintenance	1 034	1.034	8	1	9	8	1	10	1.00	8	1	10
12. Marine Coatings	1 112	1 112	1		1	1		1	1 00	1		1
13. Oth. Specity. Purpose Ctng	1.034	1.034	8	1	9	8	1	10	1.00	8	1	10
Graphic Arts:	1 034	1.034	10	2	12	10	2	12	1.00	10	2	12
Cutback & Emulsified Asphalt (com	1 034	1.034	0	0	0	0	0	0	1.00	0	0	0
Comm./Consumer Solvent:	1.034	1.034	45	7	52	46	7	54	0 82	38	6	44
Pesticide Use	1.034	1.034	4	2	6	4	2	6	1.00	4	2	6
Misc. Emissions:												
1. Bakeries	1 034	1.034	5	1	6	5	1	6	1.00	5	1	6
2. Petroleum Spills	1.038	1.038	2	0	2	2	0	3	1 00	2	0	3
3. Asphalt Roofing	1.034	1.034	0	0	0	0	0	0	1.00	0	0	0
4. Leaking UST	1.038	1.038	0	0	0	0	0	0	1.00	0	0	0
5. Chemical Storage Tanks	1 038	1 038	6	0	7	7	0	7	1.00	7	0	7
Small Stationary Fuel Combustion:												
1. Residential 0 1653	1.034	1 034	0	0	0	0	0	0	1 00	0	0	0
2. Comm./Institutional 0.503	1.034	1.034	1	0	1	1	0	1	1 00	1	0	1
3. Industrial 0.3317	1.038	1.038	1	0	1	1	0	1	1.00	1	0	1
Forest Fires:	1.000	1.000	0	0	0	0	0	0	1 00	0	0	0
Solid Waste Incineration:												
1. Residential	1.034	1.034	0	0	0	0	0	0	1.00	0	0	0
2. Comm./Institutional	1.034	1.034	0	0	0	0	0	0	1.00	0	0	0
3 Industrial	1.038	1 038	0	0	0	0	0	0	1.00	0	0	0
Structural Fires	1 034	1.034	2	0	3	2	0	3	1 00	2	0	3
Food Preparation												
1. Backyard Grills	1 034	1 034	3	0	3	3	0	3	1.00	3	0	3
2. Commercial Charbroiling	1 034	1 034	1	0	1	1	0	2	1 00	1	0	2
Area Source TOTAL (minus perchloroethylene)			313	49	362	330	52	383		295	47	342
					362			383				342
Mobile Source Emissions												
On-Road Mobile (1996 EF)												
1. Urban	1.225	1.225										
2. Small Urban	1.324	1.324										
3. Rural	1.251	1.251										
4. Total	1.236	1.236	190 (90VMT*99EF)	40	230	235 (99VMT*99EF - unc)	50	285	0.51	118 (99VMT*99EF - cntl)	26	144
On road mobile source total			190	40	230	235	50	285		118	26	144
Off road Mobile Emissions												
Aircraft Operations:												
1. Logan	1.074	1.074	3.50		4	4		4	1.00	4		4
2. Others	1.143	1.143	1.20	0.32	2	1	0	2	1.00	1	0	2
Railroads:	1.000	1.000	0	0	1	0	0	1	1.00	0	0	1
Marine Vessels:												
1. Recreation (incl. in off-highw	1.034	1.034							1.00			
2. Commercial	1.123	1.123	1		1	1		1	1.00	1		1
Off-Highway:												
Total off-highway emissions	1.034	1.034	172	29	201	178	30	208	0.89	151	25	176
1. Farm Equip.	1.179	1.179							1.00			
2. Construction Equip.	1.098	1.098							1.00			
3. Industrial Equip	1 038	1.038							1.00			
4. Off-road Motorcycles	1.034	1.034							1.00			
5. Lawn & Garden	1.034	1.034							1.00			
6. Snowmobiles	1.034	1.034							1.00			
Off road mobile source total			177 81	29 77	208	184	31	215		157	26	183
					208			215				183
Mobile Source Emissions TOTAL			368	70	438	419	80	500		275	52	327
Total Massachusetts Emissions			727	129	856	798	143	941		608	108	716
								Target Level of Emissions		603	107	710

	VOC Growth Factor	NOx Growth Factor	1990 NOx Emissions East	West	Total	1999 Uncontrolled NOx Emissions East	West	Total	1-(NOx Control Efficiency)	1999 Controlled NOx Emiss East	West	Total
Stationary Source Emissions												
1. Non-utility	1.038	1.038	56	7	64	58	8	66	0.94	57	5	62
2. Utility	1.201	1.201	277	20	297	333	24	357	0.52	173	13	186
Stationary Source TOTAL			333	27	361	391	32	423		230	18	248
Area Source Emissions												
Waste Treatment Emission:												
1.Publicly Owned Treatment Works (POTW)	1.038	1.038							1.00			
2. Haz. Waste Treatment	1.038	1.038							1.00			
3. MSW Landfill	1.067	1.067							1.00			
Gasoline Distr.												
1. Tank Truck Unloading	1.188	1.188							1.00			
2. Vehicle Refuel	1.188	1.188							1.00			
3. Underground Tank Breathing	1.188	1.188							1.00			
4. Transit losses	1.188	1.188							1.00			
5. Aircraft Refuel.	1.188	1.188							1.00			
6. Petrol. Vessels	1.188	1.188							1.00			
Stationary Source Solvent Evap.:												
1. Dry Cleaning	1.137	1.137							1.00			
2. Surface Cleaning	1.051	1.051							1.00			
Non-Indust. Surface Coating:												
1. Arch. Coating	1.034	1.034							1.00			
2. Auto Refinish.	1.231	1.231							1.00			
3. Traffic Marking	1.034	1.034							1.00			
Indust. Coating:												
1. Furniture	1.051	1.051							1.00			
2. Metal Containers	1.034	1.034							1.00			
3. Motor Vehicles New	1.000	1.000							1 00			
4 Machin. & Equip.	1.000	1.000							1.00			
5. Appliances	1.009	1.009							1.00			
6. Other Transportation Equip	1.112	1.112							1.00			
7. Metal Sheet, Strip, Coil	1.009	1.009							1.00			
8. Factory Finished Wood	1.123	1.123							1.00			
9 Elect. Insulation	1.017	1.017							1.00			
10. Other Product Coating	1.034	1.034							1.00			
11. High Perf. Maintenance	1.034	1.034							1.00			
12. Marine Coatings	1.112	1.112							1.00			
13. Oth. Specity. Purpose Ctng	1.034	1.034							1.00			
Graphic Arts:	1.034	1.034							1.00			
Cutback & Emulsified Asphalt (com	1.034	1.034							1.00			
Comm./Consumer Solvent:	1.034	1.034							1.00			
Pesticide Use	1.034	1.034							1.00			
Misc. Emissions:												
1. Bakeries	1.034	1.034							1.00			
2. Petroleum Spills	1.038	1.038							1.00			
3. Asphalt Roofing	1.034	1.034							1.00			
4. Leaking UST	1.038	1.038							1.00			
5. Chemical Storage Tanks	1.038	1.038							1.00			
Small Stationary Fuel Combustion:									1.00			
1. Residential 0.1653	1.034	1 034	5	1	5	5	1	5	1.00	5	1	5
2. Comm./Institutional 0 503	1.034	1.034	14	2	16	14	2	17	1.00	14	2	17
3. Industrial 0.3317	1.038	1.038	9	1	11	10	1	11	1.00	10	1	11
Forest Fires:	1.000	1.000	0	0	0	0	0	0	1.00	0	0	0
Solid Waste Incineration:												
1. Residential	1.034	1.034							1.00			
2. Comm./Institutional	1.034	1.034							1.00			
3. Industrial	1.038	1.038							1.00			
Structural Fires	1.034	1.034	0	0	0	0	0	0	1.00	0	0	0
Food Preparation												
1. Backyard Grills	1.034	1.034							1 00			
2. Commercial Charbroiling	1.034	1.034							1.00			
Area Source TOTAL (minus perchloroethylene)			28	4	32	29	5	34		29	5	34
					32			34				34
Mobile Source Emissions												
On-Road Mobile (1996 EF)												
1. Urban	1.225	1.225										
2. Small Urban	1.324	1.324										
3. Rural	1.251	1.251										
4. Total	1.236	1.236	253 (90VMT*99EF)	53	306	313 (99VMT*99E	65	379	0.77	239 (99VMT*99EF - cnd)	51	290
On road mobile source total			253	53	306	313	65	379		239	51	290
Off road Mobile Emissions												
Aircraft Operations:												
1. Logan	1.074	1 074	5		5	6		6	1.00	6		6
2. Others	1.143	1.143	0	0	1	0	0	1	1.00	0	0	1
Railroads:	1.000	1.000	7	3	11	7	3	11	1.00	7	3	11
Marine Vessels:												
1. Recreation (incl. in off-highw	1.034	1.034							1.00			
2. Commercial	1.123	1.123	6		6	7		7	1.00	7		7
Off-Highway:												
Total off-highway emissions	1.034	1.034	137	17	154	142	17	159	1.00	142	17	159
1. Farm Equip.	1.179	1.179							1.00			
2. Construction Equip.	1.098	1.098							1.00			
3. Industrial Equip.	1.038	1.038							1.00			
4. Off-road Motorcycles	1.034	1.034							1.00			
5. Lawn & Garden	1.034	1.034							1.00			
6. Snowmobiles	1.034	1.034							1.00			
Off road mobile source total			157	20	177	162	21	183		162	21	183
					177			183				
Mobile Source Emissions TOTAL			410	73	483	476	86	561		401	72	473
Total Massachusetts Emissions			771	104	876	896	122	1018		660	94	754
									Target Level of Emissions	702	95	797

1999 Projected Emissions Inventory
Technical Support

TABLE I

UTILITY POINT SOURCES
NOX REDUCTIONS IN TONS PER YEAR (1991)

	EAST		*WEST*	
SOURCE CATEGORY	**BEFORE**	**AFTER**	**BEFORE**	**AFTER**
Utility Boilers*	92,688	45,594	5,033	2,975
Oil Turbine	221	102	137	63
Gas Turbine	331	106	1,055	338
Oil Recip. Engine	422	346	0	0
Gas Recip. Engine	0	0	0	0
TOTALS:	93,662	46,148	6,225	3,376
% OVERALL REDUCTION	53%		46%	

* All but two utilities are implementing RACT through permanent process changes and have rule effectiveness of 100 percent. The reductions from the utilities using control equipment to implement RACT have been reduced using a rule effectiveness of 80 percent.

Table II

Expected Percent Reductions in Emission for Categories Subject to NO_x RACT*

(Does not include utility boilers)

Emission Unit	Percent Reduction
Boiler - oil ≥ 100 mmBtu/hr	27
Boiler - gas ≥ 100 mmBtu/hr	49
Boiler - oil < 50 & ≥ 100 mmBtu/hr	18
Boiler - gas < 50 & ≥ 100 mmBtu/hr	45
Boiler - oil < 20 & ≥ 50 mmBtu/hr	5
Boiler - gas < 20 & ≥ 50 mmBtu/hr	5
Turbine - oil	54
Turbine - gas	68
Reciprocating engine, rich burn - oil	18
Reciprocating engine, lean burn - gas	12
Incinerator	0
Other**	0

* Percent reductions represent permanent changes in operations and thus get 100 percent rule effectiveness.

** Other - will be determined by single source SIP revision. No credit taken at this time.

TABLE III

NON-UTILITY POINT SOURCES
NOX REDUCTIONS IN TONS PER YEAR (1991)

	EAST		*WEST*	
SOURCE CATEGORY	**BEFORE**	**AFTER**	**BEFORE**	**AFTER**
Large Oil Boiler	1,693	1,067	212	134
Large Gas Boiler	6,191	3,157	275	140
Medium Oil Boiler	492	403	216	177
Medium Gas Boiler	99	54	0	0
Small Oil Boiler	270	257	7	7
Small Gas Boiler	62	59	0	0
Oil Turbine	74	34	0	0
Gas Turbine	53	17	0	0
Oil Recip. Engine	3,734	3,062	0	0
Gas Recip. Engine	162	143	0	0
Incinerator	7,404	7,404	263	263
Glass Furnace	1,378	1,378	0	0
Other	146*	146*	825*	825*
TOTALS:	21,612	17,181	1,798	1,546
% OVERALL REDUCTION	21%		14%	

* These emissions are from sources that may undergo single source SIP revisions and no credit has been taken although reductions are anticipated.

Total unadjusted 1990 VOC emissions from EPA Offroad study in TPSD
Segregated by applicability of future emissions standards

	East-2str	West-2str	East-4str	West-4str	East-dsl	West-dsl
Small Gas	39.00	7.75	35.81	6.36	0.00	0.00
Marine IB/SD	0.00	0.00	21.71	3.22	0.00	0.00
Marine OB/PWC	47.09	8.02	0.04	0.00	0.00	0.00
Small Diesel	0.00	0.00	0.00	0.00	12.97	1.26
Remainder	2.92	0.51	7.04	0.96	2.97	0.79
Total	89.01	16.28	64.6	10.54	15.94	2.05

MA 1990 VOC Emissions	East	West	Total
	169.55	28.87	198.42

Add in the hot soak and running loss emissions to the 2str and 4str VOC emissions
From EPA/OMS Mach 17, 1994 guidance

	2str	4str
Hot soak %	0.30	2.00
Running loss %	0.20	1.00

Total Adjusted VOC emissions

	East-2str	West-2str	East-4str	West-4str	East-dsl	West-dsl
Small Gas	39.20	7.79	36.88	6.55	0.00	0.00
Marine IB/SD	0.00	0.00	22.36	3.32	0.00	0.00
Marine OB/PWC	47.33	8.06	0.04	0.00	0.00	0.00
Small Diesel	0.00	0.00	0.00	0.00	12.97	1.26
Remainder	2.93	0.51	7.25	0.99	2.97	0.79
Total	89.46	16.36	66.54	10.86	15.94	2.05

MA 1990 VOC Emissions with HS and RL	East	West	Total
	171.93	29.27	201.20

Grow out the emissions to the Target Years
1996 target year - growth factor of : 1.022

	East-2str	West-2str	East-4str	West-4str	East-dsl	West-dsl
Small Gas	40.06	7.96	37.70	6.69	0.00	0.00
Marine IB/SD	0.00	0.00	22.85	3.39	0.00	0.00
Marine OB/PWC	48.37	8.24	0.04	0.00	0.00	0.00
Small Diesel	0.00	0.00	0.00	0.00	13.26	1.29
Remainder	3.00	0.52	7.41	1.01	3.04	0.81
Total	91.42	16.72	68.00	11.10	16.29	2.10

MA 1996 Uncontrolled VOC Emissions	East	West	Total
	175.72	29.91	205.63

1999 target year - growth factor of : 1.034

	East-2str	West-2str	East-4str	West-4str	East-dsl	West-dsl
Small Gas	40.53	8.05	38.14	6.77	0.00	0.00
Marine IB/SD	0.00	0.00	23.12	3.43	0.00	0.00
Marine OB/PWC	48.93	8.33	0.04	0.00	0.00	0.00
Small Diesel	0.00	0.00	0.00	0.00	13.41	1.30
Remainder	3.03	0.53	7.50	1.02	3.07	0.82
Total	92.50	16.92	68.80	11.23	16.48	2.12

MA 1999 Uncontrolled VOC Emissions	East	West	Total
	177.78	30.26	208.04

Grow out the emissions to the Target Year
1999 target year - growth factor of : 1.034

	East-2str	West-2str	East-4str	West-4str	East-dsl	West-dsl
Small Gas	40.53	8.05	38.14	6.77	0.00	0.00
Marine IB/SD	0.00	0.00	23.12	3.43	0.00	0.00
Marine OB/PWC	48.93	8.33	0.04	0.00	0.00	0.00
Small Diesel	0.00	0.00	0.00	0.00	13.41	1.30
Remainder	3.03	0.53	7.50	1.02	3.07	0.82
Total	92.50	16.92	68.80	11.23	16.48	2.12

MA 1999 Uncontrolled VOC Emissions	East	West	Total
	177.78	30.26	208.04

Separate out the different components of VOC emissions from gasoline engines for 1999
Note that these five components do NOT add up to the total emissions

1999	East-2str	West-2str	East-4str	West-4str
Exhaust (87.62/87.5)				
Small Gas	35.51	7.05	33.42	5.93
Marine IB/SD	0.00	0.00	20.26	3.00
Marine OB/PWC	42.88	7.29	0.04	0.00
Small Diesel	0.00	0.00	0.00	0.00
Remainder	2.66	0.46	6.57	0.89
Diurnal Evap. (6.22/7.00)				
Small Gas	2.52	0.56	2.37	0.47
Marine IB/SD	0.00	0.00	1.44	0.24
Marine OB/PWC	3.04	0.58	0.00	0.00
Small Diesel	0.00	0.00	0.00	0.00
Remainder	0.19	0.04	0.47	0.07
Hot soak (0.3/0.3,2/2)				
Small Gas	0.12	0.02	0.76	0.14
Marine IB/SD	0.00	0.00	0.46	0.07
Marine OB/PWC	0.15	0.03	0.00	0.00
Small Diesel	0.00	0.00	0.00	0.00
Remainder	0.01	0.00	0.15	0.02
Running Loss (0.2/0.2, 1/1)				
Small Gas	0.08	0.02	0.38	0.07
Marine IB/SD	0.00	0.00	0.23	0.03
Marine OB/PWC	0.10	0.02	0.00	0.00
Small Diesel	0.00	0.00	0.00	0.00
Remainder	0.01	0.00	0.07	0.01
Refuleing (3.71/3.49)				
Small Gas	1.50	0.28	1.41	0.24
Marine IB/SD	0.00	0.00	0.86	0.12
Marine OB/PWC	1.82	0.29	0.00	0.00
Small Diesel	0.00	0.00	0.00	0.00
Remainder	0.11	0.02	0.28	0.04

Determine the REDUCTIONS from using Class C reformulated gasoline
Calculated by OMS Guidance as going from RVP 9.0 to RVP 8.1

1999	East-2str	West-2str	East-4str	West-4str
Exhaust (3.3)				
Small Gas	1.17	0.23	1.10	0.20
Marine IB/SD	0.00	0.00	0.67	0.10
Marine OB/PWC	1.41	0.24	0.00	0.00
Small Diesel	0.00	0.00	0.00	0.00
Remainder	0.09	0.02	0.22	0.03
Diurnal Evap. (7.00)				
Small Gas	0.18	0.04	0.17	0.03
Marine IB/SD	0.00	0.00	0.10	0.02
Marine OB/PWC	0.21	0.04	0.00	0.00
Small Diesel	0.00	0.00	0.00	0.00
Remainder	0.01	0.00	0.03	0.01
Hot soak (34)				
Small Gas	0.04	0.01	0.26	0.05
Marine IB/SD	0.00	0.00	0.16	0.02
Marine OB/PWC	0.05	0.01	0.00	0.00
Small Diesel	0.00	0.00	0.00	0.00
Remainder	0.00	0.00	0.05	0.01
Running Loss (40)				
Small Gas	0.03	0.01	0.15	0.03
Marine IB/SD	0.00	0.00	0.09	0.01
Marine OB/PWC	0.04	0.01	0.00	0.00
Small Diesel	0.00	0.00	0.00	0.00
Remainder	0.00	0.00	0.03	0.00
Refuleing (5.5)				
Small Gas	0.08	0.02	0.08	0.01
Marine IB/SD	0.00	0.00	0.05	0.01
Marine OB/PWC	0.10	0.02	0.00	0.00
Small Diesel	0.00	0.00	0.00	0.00
Remainder	0.01	0.00	0.02	0.00

Total projected emissions in 1999 with reformulated gasoline

with ASTM Class C

	East-2str	West-2str	East-4str	West-4str	East-dsl	West-dsl
Small Gas	32.16	6.38	29.60	5.25	0.00	0.00
Marine IB/SD	0.00	0.00	20.01	2.96	0.00	0.00
Marine OB/PWC	43.25	7.36	0.04	0.00	0.00	0.00
Small Diesel	0.00	0.00	0.00	0.00	13.26	1.29
Remainder	2.68	0.47	6.49	0.88	3.04	0.81
Total	78.09	14.21	56.13	9.10	16.29	2.10

MA 1999 VOC Emissions with Class C	East	West	Total
	150.52	25.41	175.92

Total unadjusted 1990 NOx emissions from EPA Offroad study in TPSD
Segregated by applicability of future emissions standards

	East-2str	West-2str	East-4str	West-4str	East-dsl	West-dsl
Small Gas	0.05	0.00	0.71	0.10	0.00	0.00
Marine IB/SD	0.00	0.00	6.52	0.81	0.00	0.00
Marine OB/PWC	0.47	0.08	0.01	0.00	0.00	0.00
Small Diesel	0.00	0.00	0.00	0.00	110.47	10.77
Remainder	3.36	0.51	1.54	0.17	14.31	4.06
Total	3.88	0.59	8.78	1.08	124.78	14.83

MA 1990 NOx Emissions	East	West	Total
	137.44	16.50	153.94

Grow out the emissions to the Target Years
1996 target year - growth factor of : 1.022

	East-2str	West-2str	East-4str	West-4str	East-dsl	West-dsl
Small Gas	0.05	0.00	0.73	0.10	0.00	0.00
Marine IB/SD	0.00	0.00	6.66	0.83	0.00	0.00
Marine OB/PWC	0.48	0.08	0.01	0.00	0.00	0.00
Small Diesel	0.00	0.00	0.00	0.00	112.90	11.01
Remainder	3.43	0.52	1.57	0.17	14.62	4.15
Total	3.97	0.60	8.97	1.10	127.53	15.16

MA 1996 Uncontrolled NOx Emissions	East	West	Total
	140.46	16.86	157.33

1999 target year - growth factor of : 1.034

	East-2str	West-2str	East-4str	West-4str	East-dsl	West-dsl
Small Gas	0.05	0.00	0.73	0.10	0.00	0.00
Marine IB/SD	0.00	0.00	6.74	0.84	0.00	0.00
Marine OB/PWC	0.49	0.08	0.01	0.00	0.00	0.00
Small Diesel	0.00	0.00	0.00	0.00	114.23	11.14
Remainder	3.47	0.53	1.59	0.18	14.80	4.20
Total	4.01	0.61	9.08	1.12	129.02	15.33

MA 1999 Uncontrolled NOx Emissions	East	West	Total
	142.11	17.06	159.17

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1           PROMPT - vertical flag input, no prompting
            MOBILE 5a 1999 Controls
1           TAMFLG - default tampering rates
1           SPDFLG - one speed per scenario
3           VMFLAG - default vehicle mix
3           MYMRFG - local registration and default mileage accrual rates
1           NEWFLG - default exhaust emission rates
3           IMFLAG - include I/M program
1           ALHFLG - no additional correction factor inputs
3           ATPFLG - no anti-tampering program
2           RLFLAG - Stage II vapor recovery program not in Base Year

2           LOCFLG - read in local area parameters one time for all scenarios
1           TEMFLG - use max/min temps
1           OUTFMT - 80 column descriptive format
1           PRTFLG - print VOC, CO, and NOx values [1-VOC,2-CO,3-NOx,4-all]
2           IDLFLG - print idle emissions results
3           NMHFLG - print VOC [3-VOCs, 1-THCs, 2-NMHC, 4-TOG, 5-NMOG]
1           HCFLAG - tot & comps HC
.800.071.036.018.011.001.057.006
.029 .064 .078 .094 .108 .111 .108 .093 .079 .053 - 1-10 age ldgv
.038 .032 .026 .026 .018 .011 .006 .004 .003 .003 - 11-20 age ldgv
.003 .002 .002 .001 .008                          - 21-25 age ldgv
.033 .080 .086 .116 .139 .134 .102 .070 .055 .036 - 1-10 age ldgt1
.024 .018 .014 .026 .020 .013 .007 .004 .004 .004 - 11-20 age ldgt1
.003 .002 .002 .001 .007                          - 11-20 age ldgt1
.033 .080 .086 .116 .139 .134 .102 .070 .055 .036 - 1-10 age ldgt2
.024 .018 .014 .026 .020 .013 .007 .004 .004 .004 - 11-20 age ldgt2
.003 .002 .002 .001 .007                          - 11-20 age ldgt2
.022 .050 .071 .112 .135 .131 .109 .065 .046 .027 - 1-10 age hdgv
.021 .023 .023 .031 .022 .015 .009 .010 .012 .014 - 11-20 age hdgv
.010 .007 .008 .006 .021                          - 21-25 age hdgv
.029 .064 .078 .094 .108 .111 .108 .093 .079 .053 - 1-10 age lddv
.038 .032 .026 .026 .018 .011 .006 .004 .003 .003 - 11-20 age lddv
.003 .002 .002 .001 .008                          - 21-25 age lddv
.033 .080 .086 .116 .139 .134 .102 .070 .055 .036 - 1-10 age lddt
.024 .018 .014 .026 .020 .013 .007 .004 .004 .004 - 11-20 age lddt
.003 .002 .002 .001 .007                          - 21-25 age lddt
.022 .050 .071 .112 .135 .131 .109 .065 .046 .027 - 1-10 age hddv
.021 .023 .023 .031 .022 .015 .009 .010 .012 .014 - 11-20 age hddv
.010 .007 .008 .006 .021                            21-25 age hddv
.023 .054 .054 .063 .061 .068 .097 .079 .052 .062 - 1-10 age mc
.078 .309 .000 .000 .000 .000 .000 .000 .000 .000 - 11-12 age mc
.000 .000 .000 .000 .000                          - blank record mc
33 20 68 80 03 03 096 1 2 2221 1111 220. 1.20 999.  .2 Speed I/M Data
33 20 81 20 03 03 096 1 2 2221 4211 0.80 15.0 2.00  .Enh I/M Data
33 81 20 2221 12 096. 22212222                      .ATP Data
33 71 20 2221 12 096.                               .Pressure Data
33 81 20 2221 12 096.                               .Purge Data
91 3 084 075                                        .Stage II VRP Data
MA Base 99 w/Reg C0006800094011.5008.5 89 1 1 2     .LAP record
4 99 02.5 85.4 20.6 27.3 20.6 7
94 1
4 99 03.0 85.4 20.6 27.3 20.6 7
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4 99 31.0 85.4 20.6 27.3 20.6 7
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94 1
4 99 44.0 85.4 20.6 27.3 20.6 7
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4 99 46.0 85.4 20.6 27.3 20.6 7
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4 99 61.1 85.4 20.6 27.3 20.6 7
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94 1
4 99 63.0 85.4 20.6 27.3 20.6 7
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4 99 64.0 85.4 20.6 27.3 20.6 7
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MOBILE SOURCE REDUCTION SUMMARY

All mobile source strategies were modeled using the most recent version of EPA's mobile source emissions model, Mobile 5a. The strategies included in the modeling runs were:

Enhanced Inspection and Maintenance Program
California Low Emission Vehicle Program
Federal Reformulated Gasoline for On-Road Vehicles
Stage II Vapor Recovery
Tier I Federal Vehicle Standards

Rather than attempting to identify the reductions associated with each of these strategies individually, the Department has chosen to model these strategies collectively. By modeling them as such it eliminates the artificially high reductions associated with the first strategy modeled.

The combined effect of these mobile source control strategies reduces VOC emissions from mobile sources by **158 tons** per summer day (tpsd) in 1999 (132 tpsd in Eastern Massachusetts and 26 tpsd in Western Massachusetts), and NOx emissions by **97 tons** per summer day (tpsd) in 1999 (81 tpsd in Eastern Massachusetts and 16 tpsd in Western Massachusetts).

Strategy Summary Sheets

MASSACHUSETTS STATE IMPLEMENTATION PLAN (SIP)
STRATEGY SUMMARY SHEET

STRATEGY NAME:

NOx Reasonably Available Control Technology (RACT) Program

APPLICABILITY:

Stationary sources with the potential to emit 50 tons/year of oxides of nitrogen (NO_x). Sources subject to this regulation that can demonstrate that "actual" NO_x emissions have been less than 50 tons/year since 1990 may obtain a permit restriction. Obtaining a permit restriction to limit potential emissions to less than 50 tons/year exempts the source from the RACT requirements.

DESCRIPTION:

Require all stationary sources of NO_x with the potential to emit 50 tons/year of VOC to implement Reasonably Available Control Technology (RACT). RACT is the emission limitation, design, or work practice that a particular facility is capable of meeting by application of control technology that is reasonably available, considering technical and economic feasibility.

The regulation contains a combination of emissions standards and performance specifications for different types of sources. The RACT standards take into account the size of the emissions unit, the fuel burned and the type of unit. Specific requirements are given for boilers, combustion turbines, reciprocating engines, and glass furnaces. There is also a requirement that RACT be defined for any individual emissions unit at a major source that is not covered by any other category (Miscellaneous RACT), that has potential emissions before air pollution control equipment of 25 tpy of NO_x.

ESTIMATED EMISSIONS REDUCTIONS (when fully implemented):
* The 1999 reductions refer to the 9% reductions milestone only, and do not address attainment.

Reductions are in tons/summer day	1996 Emissions Reductions			1999 Emissions Reductions		
	Western Massachusetts	Eastern Massachusetts	Statewide Total	Western Massachusetts	Eastern Massachusetts	Statewide Total
VOC (tpsd)	0	0	0	0	0	0
NOx (tpsd)	N/A	N/A	N/A	9	103	112

MASSACHUSETTS STATE IMPLEMENTATION PLAN (SIP)
STRATEGY SUMMARY SHEET

STRATEGY NAME:

NOx Reasonably Available Control Technology (RACT) Program

IMPLEMENTATION SCHEDULE:

Adopted by: Regulation submitted to Secretary of State 12/17/93
310 CMR 7.19 promulgated 12/31/93

Regulation revisions submitted to Secretary of State 8/27/93
Revisions to 310 CMR 7.19 promulgated 9/10/93

Regulation revisions submitted to Secretary of State 6/30/94
Revisions to 310 CMR 7.19 promulgated 7/1/94

Implemented by: 5/95

PRELIMINARY RESOURCES ANALYSIS:

Total FTE for implementation: See FY 94 Resource Plan, submitted 11/15/93.

OTHER:

310 CMR 7.19 was submitted to the EPA on 7/15/94.

MASSACHUSETTS STATE IMPLEMENTATION PLAN (SIP)
STRATEGY SUMMARY SHEET

STRATEGY NAME:

California Low Emission Vehicle Program

APPLICABILITY:

Manufacturers of passenger cars and light duty trucks less than 5,750 pounds LVW

DESCRIPTION:

This program requires the sale of vehicles certified to the California low emitting vehicle standards (CARB Title 13) in Massachusetts, beginning with model year 1995. Starting in 1998, 2% of all new vehicles sold must be zero emitting. This sales mandate increases to 5% in 2001 and to 10% in 2003. Program enforcement is implemented by the Registry of Motor Vehicles through registration denial of non-compliant vehicles.

ESTIMATED EMISSIONS REDUCTIONS (when fully implemented):
* The 1999 reductions refer to the 9% reductions milestone only, and do not address attainment.

Reductions are in tons/summer day	1996 Emissions Reductions			1999 Emissions Reductions		
	Western Massachusetts	Eastern Massachusetts	Statewide Total	Western Massachusetts	Eastern Massachusetts	Statewide Total
VOC (tpsd)	See Mobile Source Reductions Summary			See Mobile Source Reductions Summary		
NOx (tpsd)						

MASSACHUSETTS STATE IMPLEMENTATION PLAN (SIP)
STRATEGY SUMMARY SHEET

STRATEGY NAME:

California Low Emission Vehicle Program

IMPLEMENTATION SCHEDULE:

Adopted by: Legislative Authority 12/27/90
Regulation submitted to Secretary of State 1/14/92
Promulgated 1/31/92 (310 CMR 7.40)

Implemented by: Effective model year 1995

PRELIMINARY RESOURCES ANALYSIS:

Total FTE for implementation: See FY 94 Resource Plan, submitted 11/15/93.

OTHER:

310 CMR 7.40 was submitted to the EPA on 11/15/93.

MASSACHUSETTS STATE IMPLEMENTATION PLAN (SIP)
STRATEGY SUMMARY SHEET

STRATEGY NAME:

Enhanced Inspection and Maintenance (I/M) Program

APPLICABILITY:

All light duty vehicles (LDV) and light duty trucks (LDT), 8500 pounds or less gross vehicle weight rating, except pre-1971 models, registered in Massachusetts.

DESCRIPTION:

The Enhanced Inspection and Maintenance Program is designed to further reduce emissions of in-use LDV and LDT by administering a more accurate test designed to the technology of the vehicle. The Enhanced program includes two test types: transient, mass-emissions testing (high tech) on 1981 and later model year vehicles using a transient, loaded-mode driving cycle plus purge and pressure tests; and two-speed idle testing plus pressure test of 1971-1980 vehicles. Emission standards are established for each subject model year vehicle and light duty truck. The Enhanced Program also includes mandatory centralized testing and registration denial enforcement systems.

ESTIMATED EMISSIONS REDUCTIONS (when fully implemented):
* The 1999 reductions refer to the 9% reductions milestone only, and do not address attainment.

Reductions are in tons/summer day	1996 Emissions Reductions			1999 Emissions Reductions		
	Western Massachusetts	Eastern Massachusetts	Statewide Total	Western Massachusetts	Eastern Massachusetts	Statewide Total
VOC (tpsd)	See Mobile Source Reductions Summary			See Mobile Source Reductions Summary		
NOx (tpsd)						

MASSACHUSETTS STATE IMPLEMENTATION PLAN (SIP)
STRATEGY SUMMARY SHEET

STRATEGY NAME:

Enhanced Inspection and Maintenance (I/M) Program

IMPLEMENTATION SCHEDULE:

Adopted by: Statutory Authority 1/14/94
Regulation submitted to Secretary of State 8/3/94
Promulgated 8/26/94 (310 CMR 60.02)

Implemented by: 1995-1996

PRELIMINARY RESOURCES ANALYSIS:

Total FTE for implementation: See FY 94 Resource Plan, submitted 11/15/93.

OTHER:

310 CMR 60.02 will be submitted to the EPA once the RFP is issued, per EPA guidance. Attached is the Secretary of State's attestation of promulgation.

#300

THE COMMONWEALTH OF MASSACHUSETTS
Office of the Secretary of State

Regulation Filing *To be completed by filing agency*

CHAPTER NUMBER: 310 CMR 60.00

CHAPTER TITLE: AIR POLLUTION CONTROL REGULATIONS FOR MOBILE SOURCES

AGENCY: DEPARTMENT OF ENVIRONMENTAL PROTECTION

SUMMARY OF REGULATION

State the general requirements and purposes of this regulation:

Amendments establish a new motor vehicle emissions inspection program to provi a more complete and accurate measure of vehicle exhaust and evaporati emissions. These provisions specify certain emissions inspection equipment a procedures at test-only inspection facilities. In addition, the amendmen provide inspection requirements for a biennial program for vehicles model yea 1974 to current model year and for vehicles weighing 8500 pounds or less, as wel as provide for the training and certification of emissions inspectors and repa technicians. M.G.L. c.111 Section 142M

REGULATORY AUTHORITY:

AGENCY CONTACT: James F.Neely PHONE: (617) 292-5629

ADDRESS: DEP/Division of Enhanced I/M, One Winter St., 7th Floor Boston, MA 02108

Compliance with M.G.L. c. 30A

EMERGENCY ADOPTION

If this regulation is adopted as an emergency regulation, state the nature of the emergency.

N/A

PRIOR NOTIFICATION AND/OR APPROVAL

If prior notification to and/or approval of the Governor, legislature or others was required, list each notification, approval and date, including notice to the Local Government Advisory Commission:

NOTIFIED May 17, 1994:

DPU, Elect. Power Div.
MEPA Program
Energy Facilities Siting Council
Exec. Office of Comm, & Develop.
Mass. Municipal Association

PUBLIC REVIEW

Was notice of the hearing or comment period filed with the Secretary of State published in appropriate newspapers and sent to persons to whom specific notice must be given at least 21 days prior to such hearing or comment period?

Yes [X] Date of public hearing or comment period: Hearings: July 5&6, 1994

Close of comments: 7/20/94

FISCAL EFFECT

Estimate the fiscal effect on the public and private sectors:

For the first and second years: Impacts to Consumers will increase for an emission inspectio
other year which will be offset, in part, by better fuel ec
For the first five years: With enhanced emissions inspection equipment and proce
No fiscal effect: emissions-related failures are more likely to accurately loc
cause for failure and suggest more cost-effective repairs
consumer. The repair industry will yield revenue benefit
result of the increased repair business.

SMALL BUSINESS IMPACT

State the impact of this regulation on small business. Include a description of reporting, record keeping and other compliance requirements as well as the appropriateness of performance versus design standards and whether this regulation duplicates or conflicts with any other regulation. If the purpose of this regulation is to set rates for the state this section does not apply.

Impacts to current inspection stations on loss of new biennial emissions program will be offset by retaining the annual safety inspection program.

Impacts to current inspection stations that perform repairs expected to generate new repair business.

CODE OF MASSACHUSETTS REGULATIONS INDEX

List key subjects entries that are relevant to this regulation:

Air Pollution — Repair Technician
Vehicle Emissions . spection — Auto Repairs
Auto Repair Traini . Certification

PROMULGATION

State the action taken by this regulation and its effect on existing provisions of the Code of Massachusetts Regulations (CMR) to repeal, replace or amend. List by CMR number:

Add 310 CMR 60.00 AIR POLLUTION CONTROL REGULATIONS FOR MOBILE SOURCES

Add 310 CMR 60.02 ENHANCED VEHICLE EMISSIONS INSPECTION AND MAINTENANCE (I/M) REGULATION

ATTESTATION

The regulation described herein and attached hereto is a true copy of the regulation adopted by this agency. ATTEST

Signature: _____ Date: 8-4-94

Publication *To be completed by the Regulations Division*

MASSACHUSETTS REGISTER NUMBER: 746 DATE: 8/26/94

EFFECTIVE DATE: 8/26/94

CODE OF MASSACHUSETTS REGULATIONS

Remove these pages: 310 CMR: Vol.	*Insert these pages:*
	1113 - 1238

A TRUE COPY ATTEST

MICHAEL JOSEPH CONNOLLY
SECRETARY OF STATE

DATE 8/3/94 CLERK

MASSACHUSETTS STATE IMPLEMENTATION PLAN (SIP)
STRATEGY SUMMARY SHEET

STRATEGY NAME:

Tier I Federal Vehicle Standards

APPLICABILITY:

This program covers all light duty vehicles (LDV) and light duty trucks (LDT), 6,000 pounds or less gross vehicle weight rating, beginning with the 1994 model year.

DESCRIPTION:

Tier I federal vehicles standards are required under Section 202(g) of the Clean Air Act. Emissions limits for non-methane hydrocarbons (NMHC), oxides of nitrogen (NOx), and carbon monoxide (CO) are specified for LDV and LDT. Emission limits for vehicles between 5 and 10 years old (or with 100,000 miles) are less stringent than the limits for vehicles up to 5 years old (or with 50,000 miles). Implementation is phased in during the period 1994-1996.

ESTIMATED EMISSIONS REDUCTIONS (when fully implemented):
* The 1999 reductions refer to the 9% reductions milestone only, and do not address attainment.

Reductions are in tons/summer day	1996 Emissions Reductions			1999 Emissions Reductions		
	Western Massachusetts	Eastern Massachusetts	Statewide Total	Western Massachusetts	Eastern Massachusetts	Statewide Total
VOC (tpsd)	See Mobile Source Reductions Summary			See Mobile Source Reductions Summary		
NOx (tpsd)						

MASSACHUSETTS STATE IMPLEMENTATION PLAN (SIP)
STRATEGY SUMMARY SHEET

STRATEGY NAME:

Tier I Federal Vehicle Standards

IMPLEMENTATION SCHEDULE:

Adopted by: November 15, 1990

Implemented by: A percentage of a manufacturer's LDV/LDT sales volume is required to meet the standard:

1994 - 40%
1995 - 80%
1996 - 100%

PRELIMINARY RESOURCES ANALYSIS:

Total FTE for implementation: 0 (Federal program)

OTHER:

MASSACHUSETTS STATE IMPLEMENTATION PLAN (SIP)
SUBMITTAL SUMMARY SHEET
(November 15, 1993)

SUBMITTAL TITLE: 1990 Base Year Emissions Inventory Adjustments

CAAA CITATION:

Section 182 (a)(1)
Section 187 (a)(1)

ACTION TYPE:
- ■ Full Submittal
- ☐ Committal
- ☐ Certification
- ☐ Opt-in/Opt-out

STATUS: ■ Final ☐ Draft

SUMMARY:

Regulation: final/draft ☐ attached ■ N/A
Letter from Governor or Designee: final/draft ☐ attached ■ N/A
Date released for public review (notice): September 6, 1994
Dates of public hearings: October 6-7, 1994

Date comment period closed: October 11, 1994
Date of adoption: Nov. 15, 1994 ■ actual ☐ estimated
Effective date: Nov. 15, 1994 ■ actual ☐ estimated

Work plan: final/draft ☐ attached ■ N/A
Schedule -- adoption of program: final/draft ☐ attached ■ N/A
Schedule -- implementation: final/draft ☐ attached ■ N/A

Comments:

The final 1990 Base Year Emissions Inventories were submitted to the EPA in November, 1993. During the course of the year, quality assurance/quality control (QA/QC) activities have identified particular areas of the Massachusetts Inventories which needed adjustment. Comments were received during public hearings and subsequent revisions were made. The replacement pages are included in this submittal.

I-7. EMISSIONS SUMMARY

The 1990 base year emissions were calculated in tons per summer day (TPSD) for VOC, NOx and CO. Emissions were also calculated in tons per winter day (TPWD) for CO.

Emissions were developed and presented for anthropogenic emissions comprising the following four broad categories: Stationary Point, Stationary Area, On-Road MOBILE5a and Non-Road Mobile Sources. Biogenic emissions were developed and presented for the VOC summer day inventory. Emissions were developed and presented by county in Tables I-4 to I-22 and Figures I-9 to I-13. CO winter emissions by CO non-attainment cities and towns are presented in Table I-19 and Figure I-14.

In the statewide anthropogenic VOC inventory for a typical summer day, the source categories account for the following contributions: Stationary Point 5.9%, Stationary Area 40.9%, On-Road MOBILE5a 31.6% and Non-Road Mobile 21.6%. The inclusion of Biogenic emissions changes to the following proportions: Stationary Point 3.5%, Stationary Area 24.4%, On-Road MOBILEa 18.8%, Non-Road Mobile 12.9% and Biogenics 40.5%. These proportions are presented in Table I-2 and Figures I-4 and I-5.

The following are the proportions of the source categories statewide for a typical summer day for NO_x: Stationary Point 37.7%, Stationary Area 3.4%, On-Road MOBILE5a 40.5% and Non-Road Mobile 18.4%. NOx emissions for these categories are presented in Table I-2 and Figure I-6.

The following are the proportions of the source categories

TABLE I-2

SUMMARY MASSACHUSETTS 1990 BASE YEAR EMISSION INVENTORIES
VOLATILE ORGANIC COMPOUNDS, NITROGEN OXIDES AND CARBON MONOXIDE (TONS PER SUMMER AND WINTER DAY)

Revised October 21 1994 (Non-road Hot Soak & Running Loss))
4suminv90

VOLATILE ORGANIC COMPOUNDS (VOC)

	TONS PER SUMMER DAY (TPSD)	%	ANTHROPOGENIC (NO BIOGENICS) TONS PER SUMMER DAY (TPSD)	%
1 STATIONARY POINT	56.34	3.50%	56.34	5.88%
2 STATIONARY AREA	391.88	24.36%	391.88	40.93%
3 ON-ROAD MOBILE5.a	302.22	18.79%	302.22	31.56%
4 NON-ROAD MOBILE	207.05	12.87%	207.05	21.62%
5 BIOGENICS	651.24	40.48%		
TOTAL	1608.73		957.49	

NITROGEN OXIDES (NOx)

	TONS PER SUMMER DAY (TPSD)	%
1 STATIONARY POINT	360.63	37.71%
2 STATIONARY AREA	32.49	3.40%
3 ON-ROAD MOBILE5.a	386.93	40.46%
4 NON-ROAD MOBILE	176.18	18.42%
TOTAL	956.23	

CARBON MONOXIDE (CO)

	TONS PER SUMMER DAY (TPSD)	%	TONS PER WINTER DAY (TPWD)	%
1 STATIONARY POINT	32.77	0.88%	32.77	0.77%
2 STATIONARY AREA	53.44	1.44%	711.95	16.78%
3 ON-ROAD MOBILE5.a	2268.26	61.15%	3387.69	79.87%
4 NON-ROAD MOBILE	1354.68	36.52%	109.36	2.58%
TOTAL	3709.15		4241.77	

TABLE I-3

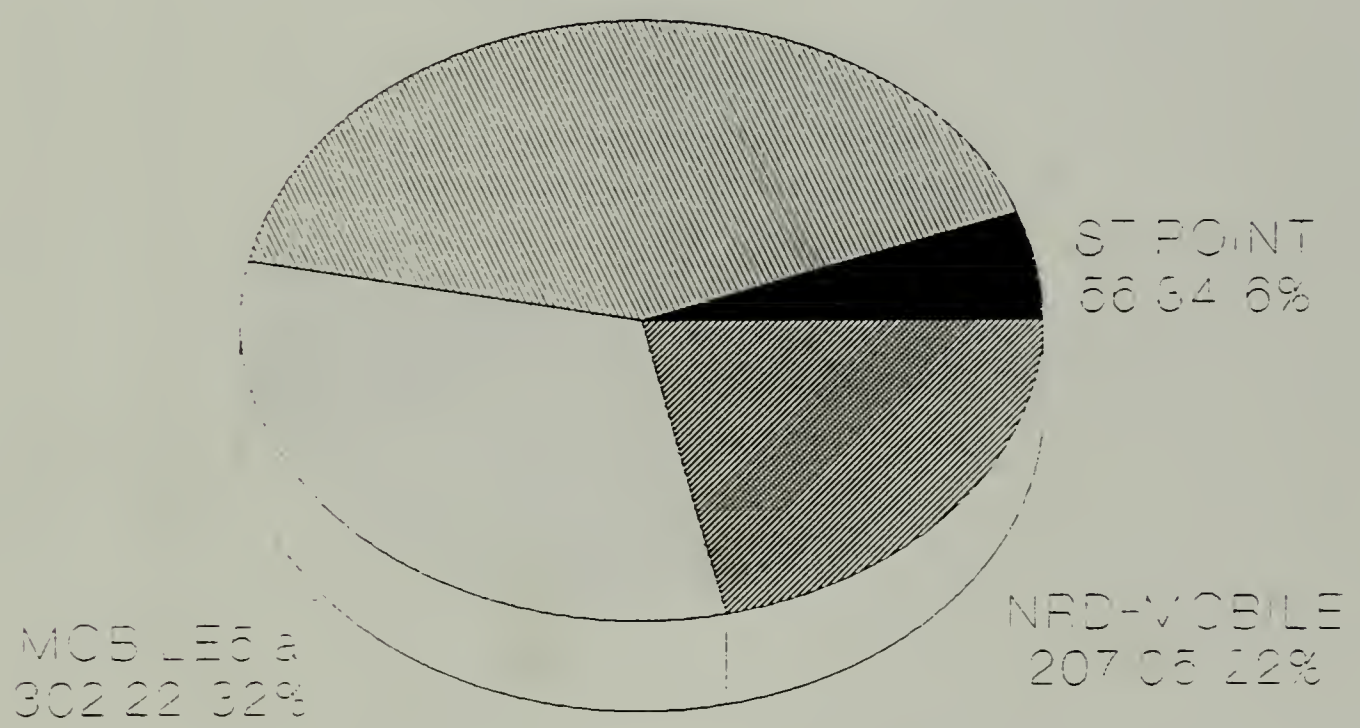
SUMMARY MASSACHUSETTS 1990 BASE YEAR EMISSION INVENTORIES
VOC, NOX AND CO TONS PER SUMMER DAY
FOR BOSTON AND SPRINGFIELD OZONE NON-ATTAINMENT AREAS

Revised Oct 21 94 (Non-Road Hot Soak & Running Loss)
sumNAA90b6

ANTHROPOGENIC VOC	BOSTON NON-ATTAINMENT AREA TONS SUMMER DAY	SPRINGFIELD NON-ATTAINMENT AREA TONS SUMMER DAY	STATE TOTAL
1 STATIONARY POINT	46.682	9.660	56.342
2 STATIONARY AREA	338.187	53.694	391.881
3 ON-ROAD MOBILE5.a	249.769	52.452	302.221
4 NON-ROAD MOBILE	177.464	29.586	207.05
TOTAL ANTHROPOGENIC	812.102	145.392	957.494
	84.8%	15.2%	100.0%
VOC WITH BIOGENICS			
1 STATIONARY POINT	46.682	9.660	56.342
2 STATIONARY AREA	338.187	53.694	391.881
3 ON-ROAD MOBILE5.a	249.769	52.452	302.221
4 NON-ROAD MOBILE	177.464	29.586	207.05
5 BIOGENICS	374.020	277.220	651.24
TOTAL VOC	1186.122	422.612	1608.734
	73.7%	26.3%	100.0%
NITROGEN OXIDES (NOx)			
1 STATIONARY POINT	333.266	27.369	360.635
2 STATIONARY AREA	28.092	4.396	32.488
3 ON-ROAD MOBILE5.a	319.681	67.253	386.934
4 NON-ROAD MOBILE	156.278	19.904	176.182
TOTAL	837.317	118.922	956.239
	87.6%	12.4%	100.0%
CARBON MONOXIDE (CO)			
1 STATIONARY POINT	26.942	5.824	32.766
2 STATIONARY AREA	45.508	7.927	53.435
3 ON-ROAD MOBILE5.a	1886.622	381.639	2268.261
4 NON-ROAD MOBILE	1176.459	178.218	1354.677
TOTAL	3135.531	573.608	3709.139
	84.5%	15.5%	100.0%

FIGURE I-4

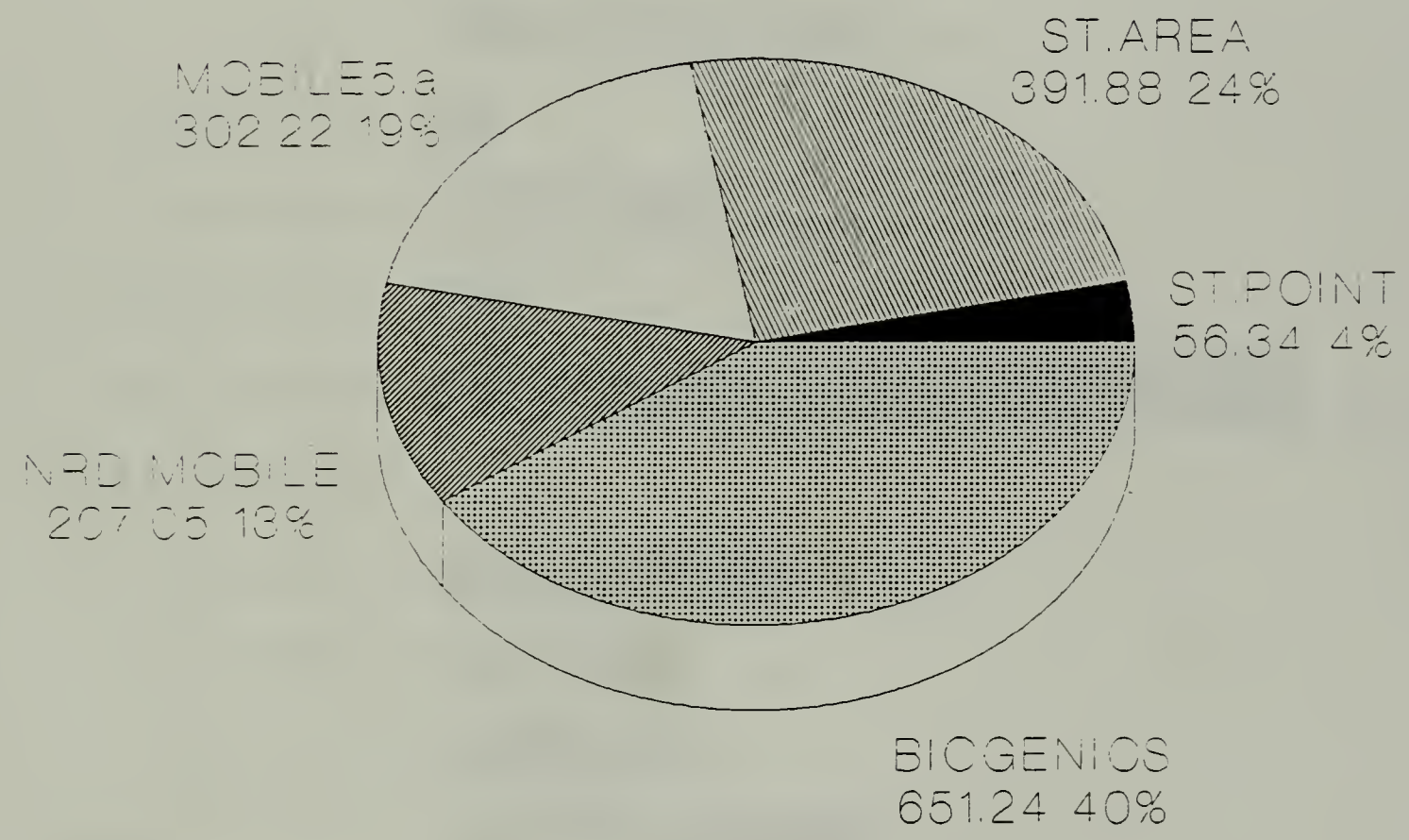
VOC ANTHROPOGENIC EMISSIONS 1990
TONS PER SUMMER DAY



10/21/94

FIGURE I-5

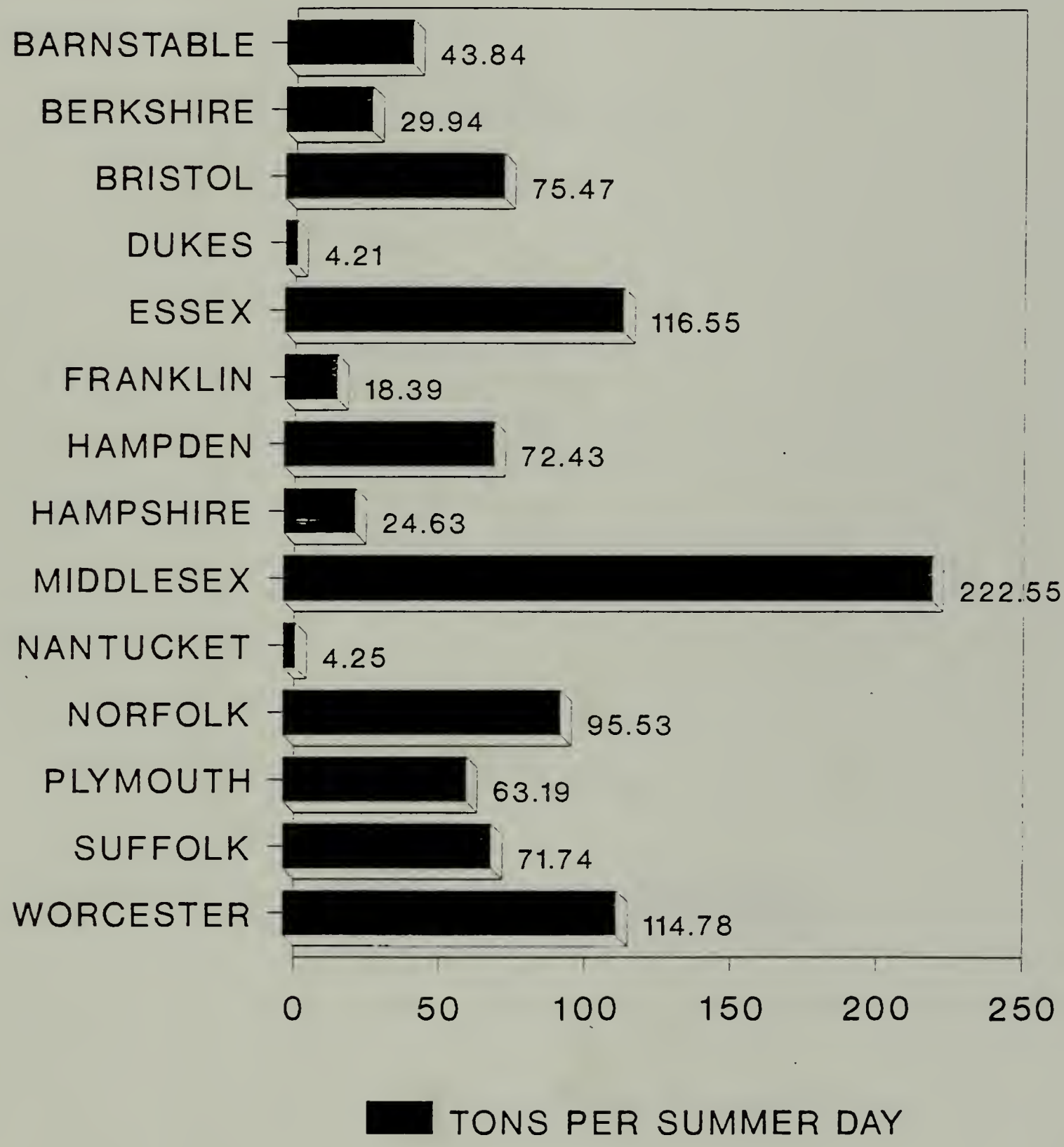
VOC EMISSIONS WITH BIOGENICS 1990
TONS PER SUMMER DAY



10/21/94

FIGURE I-8

VOC ANTHROPOGENIC EMISSIONS 1990
TONS PER SUMMER DAY



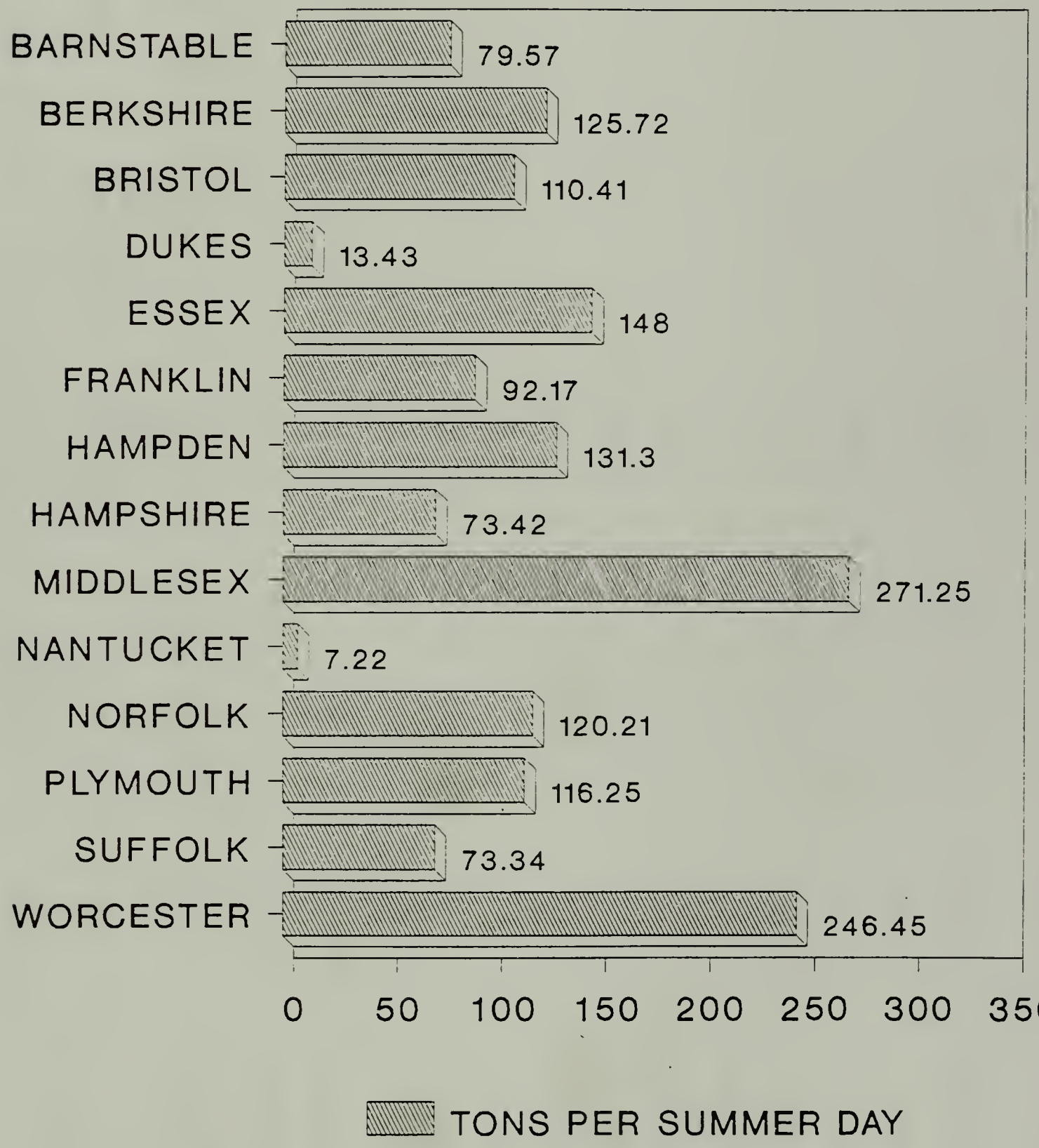
nox90

10/21/94

vi

FIGURE I-9

VOC WITH BIOGENICS EMISSIONS 1990
TONS PER SUMMER DAY



10/21/94

TABLE I-12

(TABLE D.4-2)

NON-ROAD MOBILE SOURCE VOC EMISSIONS 1990 TPY AND TPSD BY COUNTY

oct 21 94
4nroadvoc

	COUNTIES	AIRCRAFT TPSD	RAILROAD TPY	RAIL TPSD	COMMERC & MILIT VESSELS TPSD	EPA-OMS NON-ROAD STUDY EM TPSD	TOTAL NON-ROAD EMISS VOC TPSD
1	BARNSTABLE	0.339	8.13	0.022	0.114	23.90	24.375
2	BERKSHIRE	0.000	18.07	0.049	0.000	5.61	5.659
3	BRISTOL	0.000	14.27	0.039	0.037	12.77	12.846
4	DUKES	0.191	0.00	0.000	0.000	2.75	2.941
5	ESSEX	0.234	19.87	0.054	0.006	20.83	21.124
6	FRANKLIN	0.000	17.52	0.048	0.000	4.80	4.848
7	HAMPDEN	0.322	19.33	0.053	0.000	13.42	13.795
8	HAMPSHIRE	0.000	8.85	0.024	0.000	5.26	5.284
9	MIDDLESEX	0.122	24.93	0.068	0.000	41.42	41.610
10	NANTUCKET	0.225	0.00	0.000	0.000	3.14	3.365
11	NORFOLK	0.054	18.07	0.049	0.004	18.80	18.907
12	PLYMOUTH	0.000	12.47	0.034	0.046	17.71	17.790
13	SUFFOLK	3.517	9.94	0.027	0.568	10.31	14.422
14	WORCESTER	0.038	38.66	0.106	0.000	19.94	20.084
	STATE	5.042	210.11	0.573	0.775	200.66	207.050 207.050

* TAKEN FROM EPA'S NON-ROAD ENGINE STUDY

TABLE I-16
ALL SOURCE CATEGORIES VOC 1990 TONS PER YEAR AND SUMMER DAY BY COUNTY

Oct 21 94 (Non-rd hot soak & running loss)
4voccat90

	COUNTY	POINT TPY	POINT TPSD	ST.AREA TPY	ST.AREA TPSD	MOBILE5.a ON-ROAD TPSD	TOTAL NON-ROAD TPSD	BIOGENIC TPSD	TOTAL ANTHROPO--GENIC VOC TPSD	TOTAL VOC WITH BIOGENIC TPSD
1	BARNSTABLE	172	0.551	3159.43	9.091	9.826	24.375	35.73	43.843	79.573
2	BERKSHIRE	333	1.067	3674.92	11.385	11.831	5.659	95.78	29.942	125.722
3	BRISTOL	2314	7.417	10149.64	29.754	25.452	12.846	34.94	75.469	110.409
4	DUKES	0	0.000	236.00	0.659	0.609	2.941	9.22	4.209	13.429
5	ESSEX	2105	6.747	17403.73	54.127	34.548	21.124	31.45	116.546	147.996
6	FRANLIN	97	0.311	1761.49	5.513	7.722	4.848	73.78	18.394	92.174
7	HAMPDEN	2448	7.846	9226.33	27.457	23.329	13.795	58.87	72.427	131.297
8	HAMPSHIRE	136	0.436	3155.00	9.339	9.570	5.284	48.79	24.629	73.419
9	MIDDLESEX	4129	13.234	33094.48	101.183	66.525	41.610	48.70	222.552	271.252
10	NANTUCKET	37	0.119	178.07	0.483	0.282	3.365	2.97	4.249	7.219
11	NORFOLK	1153	3.696	12543.22	36.812	36.113	18.907	24.68	95.528	120.208
12	PLYMOUTH	484	1.551	7938.64	23.179	20.670	17.790	53.06	63.190	116.250
13	SUFFOLK	1873	6.003	12160.04	34.758	16.555	14.422	1.60	71.738	73.338
14	WORCESTER	2298	7.365	15762.86	48.141	39.189	20.084	131.67	114.779	246.449
	STATE	17579	56.343	130443.85	391.881	302.221	207.050	651.24	957.495	1608.735

TABLE I-20
ALL SOURCE CATEGORIES VOC 1990 TONS PER YEAR AND SUMMER DAY BY NON-ATTAINMENT AREAS

Oct 21 94 (Non Rd Hot Soak & Running loss)

6vocNAA90 COUNTY	POINT TPY	POINT TPSD	ST.AREA TPY	ST.AREA TPSD	MOBILE5.a ON-ROAD TPSD	TOTAL NON-ROAD TPSD	BIOGENIC TPSD	TOTAL ANTHROPO--GENIC VOC TPSD	TOTAL VOC WITH BIOGENIC TPSD
BOSTON NON-ATTAINMENT AREA									
1 BARNSTABLE	172	0.551	3159.43	9.091	9.826	24.375	35.73	43.843	79.573
3 BRISTOL	2314	7.417	10149.64	29.754	25.452	12.846	34.94	75.469	110.409
4 DUKES	0	0.000	236.00	0.659	0.609	2.941	9.22	4.209	13.429
5 ESSEX	2105	6.747	17403.74	54.127	34.548	21.124	31.45	116.546	147.996
9 MIDDLESEX	4129	13.234	33094.48	101.183	66.525	41.610	48.70	222.552	271.252
10 NANTUCKET	37	0.119	178.07	0.483	0.282	3.365	2.97	4.249	7.219
11 NORFOLK	1153	3.696	12543.22	36.812	36.113	18.907	24.68	95.528	120.208
12 PLYMOUTH	484	1.551	7938.64	23.179	20.670	17.790	53.06	63.190	116.250
13 SUFFOLK	1873	6.003	12160.04	34.758	16.555	14.422	1.60	71.738	73.338
14 WORCESTER	2298	7.365	15762.86	48.141	39.189	20.084	131.67	114.779	246.449
BOSTON N.A.	14565	46.682	112626.12	338.187	249.769	177.464	374.02	812.103	1186.123
SPRINGFIELD NON-ATTAINMENT AREA									
2 BERKSHIRE	333	1.067	3674.92	11.385	11.831	5.659	95.78	29.942	125.722
6 FRANKLIN	97	0.311	1761.49	5.513	7.722	4.848	73.78	18.394	92.174
7 HAMPDEN	2448	7.846	9226.33	27.457	23.329	13.795	58.87	72.427	131.297
8 HAMPSHIRE	136	0.436	3155.00	9.339	9.570	5.284	48.79	24.629	73.419
SPRINGFLD NA	3014	9.6602	17817.74	53.694	52.452	29.586	277.22	145.392	422.612
STATE	17579	56.342	130443.86	391.881	302.221	207.05	651.24	957.495	1608.735

engines share this same percentage, although it is more likely, given the proximity of the gasoline tank and the hot engine, that nonroad engines would have a higher percentage. With these assumptions, the EPA nonroad inventory represents only 66% of the actual nonroad emissions in /1990, in order to derive the real inventory EPA numbers must be multiplied by 1.52 (1/0.66=1.52).

EPA's September 29 1994 letter strongly recommended that this 1.52 factor for hot soak and running losses, should be revised. Based on EPA OMS recommendation, this factor is now adjusted to 1.03 for 4-cycle engines and 1.005 for 2-cycle. This adjustment does not affect NOx or CO emissions.

The October 1994 revised emissions from this study for the state were estimated at 200.67 TPSD for VOC, 153.59 TPSD for NO_x, 1,337.17 TPSD and 91.85 TPWD for CO. These emissions are summarized in Table D.4-1 and the EPA documentation for the study is presented at the end of this section.

SUMMARY TOTAL NON-ROAD EMISSIONS

Total revised emissions for the Non-Road Mobile Source category amounted to 207.05 TPSD for VOC, 176.18 TPSD for NO_x, 1,354.68 TPSD for CO and 109.36 TPWD for CO. Non-Road Mobile summary emissions are presented by counties in Table D.4-2 to D.4-4

nonroad

xi

TABLE D.4-1

October 21,1994

EPA-OMS NON-ROAD STUDY EMISSIONS

COUNTIES	VOCs 4AB 4CYCLE	*1.03 VOCs 4AB 4CYCLE	NOXs 4AB 4CYCLE	COw 4AB 4CYCLE	COs 4AB 4CYCLE	VOCs 2AB 2CYCLE	*1.005 VOCs 2AB 2CYCLE	NOXs 2AB 2CYCLE	COw 2AB 2CYCLE	COs 2AB 2CYCLE	VOCs DAB DIESEL	NOXs DAB DIESEL	COw DAB DIESEL	COs DAB DIESEL	TOTAL VOC SUM	TOTAL NOX SUM	TOTAL CO SUM	TOTAL CO WIN
Barnstable	8 06	8.30	1.58	0 00	94.52	14.97	15.04	0.13	0.00	28 75	0.56	4.72	0.00	2.64	23.90	6.43	125.91	0.00
Berkshire	1.98	2.04	0.16	0 00	24.92	3.09	3 11	0.09	0 00	6 47	0.46	3.41	0.00	2.03	5.61	3.66	33.42	0 00
Bristol	4 83	4.97	0.55	0.00	67.95	6 43	6 46	0.32	0 00	13 98	1.34	10.34	0.00	6.08	12.77	11.21	88.01	0.00
Dukes	0 86	0.89	0.21	0.00	9.68	1 77	1 78	0 02	0 00	3.31	0 08	0 73	0.00	0.40	2.75	0.96	13.39	0.00
Essex	8.10	8 34	1 04	0 00	112.53	10.79	10.84	0.62	0.00	23 28	1.65	12 91	0.00	7.42	20.83	14.57	143.23	0.00
Franklin	1.49	1.53	0.19	0 00	17.00	3 01	3 03	0 04	0 00	5 92	0.24	1.68	0.00	1.06	4.80	1.91	23.98	0.00
Hampden	5.30	5.46	0.55	7.57	71.17	7 05	7 09	0.39	1 10	15.56	0.87	6.78	0.35	3.80	13.42	7.72	90.53	9.02
Hampshire	1.73	1.78	0.14	0 00	20.97	3 05	3 07	0 06	0.00	6 01	0.41	2.95	0.00	1.86	5.26	3.15	28.84	0.00
Middlesex	16 62	17.12	2.07	20.25	247.30	19.82	19.92	1.40	2.76	45.3	4.38	34 46	1.26	19.81	41.42	37.93	312.41	24.27
Nantucket	1.05	1.08	0.24	0.00	11.87	2 00	2.01	0 02	0.00	3.79	0.05	0.46	0.00	0.23	3.14	0.72	15.89	0.00
Norfolk	7.52	7.75	0.82	5.42	110.16	9 10	9.15	0.40	0.62	19.36	1.90	15.10	0.28	8.71	18.80	16.32	138.23	6.32
Plymouth	6.35	6.64	0.71	0.00	83.34	9.96	10 01	0.18	0 00	19 69	1.16	8.96	0.00	5.31	17.71	9.85	108.34	0.00
Suffolk	3.96	4.08	0.56	35.46	66.13	3.84	3 86	0.33	3.17	9 05	2.37	19.49	4.85	10.15	10.31	20.38	85.33	43.48
Worcester	7.05	7.26	0.75	7.18	97.76	10.29	10.34	0.38	0.94	21.51	2.34	17.65	0.64	10.39	19.94	18.78	129.66	8.76
ST. TOTAL	74.90 TPSD	77.16 TPSD	9.57 TPSD	75.88 TPWD	1035.3 TPSD	105.17 TPSD	105 71	4.38 TPSD	8.59 TPWD	221.98 TPSD	17.81 TPSD	139.64 TPSD	7.38 TPWD	79.89 TPSD	200.67 TPSD	153.59 TPSD	1337.17 TPSD	91.85 TPWD

SOURCE: Final EEA Non-Road Study Diskettes (Oct-'92) Boston/Springfield CMSA

200,670

** Letter from Mary Nichols: Region 1 EPA (29, Sept, '94) disapproving the VOC Adjustment for HOT Soak/Running Loss Emissions by a factor of 1.62

** VOC Emissions for 2 stroke, 4 stroke Engines (Gasoline): 79 equipment-types adjusted by .5% & 3% respectively: OMS Memoranda: (17, March '94)

** Ozone/CO Emission Inventory Inventory (A+B)/2 (TPSD/TPWD). OMS Memo: (April '92)

AIRS-AMS

.- Tapes of the Final Non-Road study prepared by Radian Corporation: Batch transaction files uploaded by NADB (April '93)

.- Y1/Y2 algorithm enhancement developed by David Misenheimer: EIB An ad-hoc program was run on our Non-Road Inventory (Jan '94) calulating Daily Activity from the Annual Activity, & recalculating VOC/NO2/CO (TPSD) & CO (TPWD) Emissions based on a 13 week (91) day Peak Ozone/CO Season

.- As of 20 Oct '94 (Development/Testing/Running) of a Non-Road Recalculation Program for those Equipment Types with Period Thruputs <25% pending

.- VOC EF Adjustments for 2- Stroke/4- Stroke Engines in AIRS pending

TABLE D.4-2

(TABLE I-12)

NON-ROAD MOBILE SOURCE VOC EMISSIONS 1990 TPY AND TPSD BY COUNTY

oct 21 94
4nroadvoc

	COUNTIES	AIRCRAFT TPSD	RAILROAD TPY	RAIL TPSD	COMMERC & MILIT VESSELS TPSD	EPA-OMS NON-ROAD STUDY EM TPSD	TOTAL NON-ROAD EMISS VOC TPSD
1	BARNSTABLE	0.339	8.13	0.022	0.114	23.90	24.375
2	BERKSHIRE	0.000	18.07	0.049	0.000	5.61	5.659
3	BRISTOL	0.000	14.27	0.039	0.037	12.77	12.846
4	DUKES	0.191	0.00	0.000	0.000	2.75	2.941
5	ESSEX	0.234	19.87	0.054	0.006	20.83	21.124
6	FRANKLIN	0.000	17.52	0.048	0.000	4.80	4.848
7	HAMPDEN	0.322	19.33	0.053	0.000	13.42	13.795
8	HAMPSHIRE	0.000	8.85	0.024	0.000	5.26	5.284
9	MIDDLESEX	0.122	24.93	0.068	0.000	41.42	41.610
10	NANTUCKET	0.225	0.00	0.000	0.000	3.14	3.365
11	NORFOLK	0.054	18.07	0.049	0.004	18.80	18.907
12	PLYMOUTH	0.000	12.47	0.034	0.046	17.71	17.790
13	SUFFOLK	3.517	9.94	0.027	0.568	10.31	14.422
14	WORCESTER	0.038	38.66	0.106	0.000	19.94	20.084
	STATE	5.042	210.11	0.573	0.775	200.66	207.050 207.050

* TAKEN FROM EPA'S NON-ROAD ENGINE STUDY

MASSACHUSETTS STATE IMPLEMENTATION PLAN (SIP)
SUBMITTAL SUMMARY SHEET
(November 15, 1994)

SUBMITTAL TITLE: Adjustments to 1996 Reasonable Further Progress Demonstration

CAAA CITATION:

Section 182(b)(1)

ACTION TYPE:
- ■ Full Submittal
- ☐ Committal
- ☐ Certification
- ☐ Opt-in/Opt-out

STATUS: ■ Final ☐ Draft

SUMMARY:

Regulation: final/draft ☐ attached ■ N/A
Letter from Governor or Designee: final/draft ☐ attached ■ N/A
Date released for public review (notice): September 6, 1994
Dates of public hearings: October 6-7, 1994

Date comment period closed: October 11, 1994
Date of adoption: Nov. 15, 1994 ■ actual ☐ estimated
Effective date: Nov. 15, 1994 ■ actual ☐ estimated

Work plan: final/draft ☐ attached ■ N/A
Schedule -- adoption of program: final/draft ☐ attached ■ N/A
Schedule -- implementation: final/draft ☐ attached ■ N/A

Comments:

During the course of the year, quality assurance/quality control (QA/QC) activities and new EPA guidance have identified areas of the 1996 Reasonable Further Progress Demonstration which needed revising. These are attached, specifically:

1996 Target Level of Emissions Calculation
1996 Projected Emissions Inventory

Subesquent revisions to remedy the discrepency between the 1996 Target Level of Emissions and the 1996 Projected Emissions Inventory for VOC will be addressed in a forthcoming SIP revision.

Massachusetts Revised 1996 Target Emission Level Calculation

10/28/94 (all calculations in tons of VOC per summer day)

with EPA offroad and RVP 9.0

Step 1	Total Emissions Inventory	Western	Eastern	Total
	Point	10	46	56
	Area	54	338	392
	On Road	52	250	302
	Off Road	30	178	208
	Biogenic	277	374	651
	Total	423	1186	1609
Step 2	Rate of Progress Inventory	- Excludes biogenics and perchloroethylene emissions		
	Point	10	46	56
	Area	49	313	363
	On Road	52	250	302
	Off road	30	178	208
	Total	142	787	929
Step 3	Adjusted Baseyear Inventory	- Using 1996 mobile EFs on 1990 VMT		
	Point	10	46	56
	Area	49	313	363
	On Road	42	198	239
	Off road	30	178	208
	Total	131	735	866
Step 4	Total reductions required			
	15% Reduction	20	110	130
	FMVCP Reduction	11	52	63
	RACT Corrections	1	7	8
	I/M Corrections	1	7	9
	Total	33	176	210
Step 5	Target level of emissions	- 1990 Rate of Progress Inventory - total reductions required		
		108	611	719

Revised 1996 Projected Emission Inventory

with EPA offroad, RVP 9.0, ASTM Class C, no cleanup solvent controls

	Growth Factor	1990 VOC Emissions East	West	Total	1996 Uncontrolled VOC Emissions East	West	Total	1-(Control Efficiency)	1996 Controlled VOC Emis East	West	Total
Waste Treatment Emission:											
1.Publicly Owned Treatment Works (POTW)	1.016	2	2	4	2	2	4	1.00	2	2	4
2. Haz. Waste Treatment	1.016	9	1	10	9	1	10	1.00	9	1	10
3. MSW Landfill	1.124	8	2	10	9	2	11	1.00	9	2	11
Gasoline Distr.											
1. Tank Truck Unloading	1.113	8	2	10	9	2	11	1.00	9	2	11
2. Vehicle Refuel	1.113	In Mobile Source Section			0	0	0	1.00	0	0	0
3. Underground Tank Breathing	1.113	3	0	4	3	1	4	1.00	3	1	4
4. Transit losses	1.113	1	0	1	1	0	1	1.00	1	0	1
5. Aircraft Refuel.	1.113	0	0	0	1	0	1	1.00	1	0	1
6. Petrol. Vessels	1.113	3	0	3	4	0	4	0.24	1	0	1
Stationary Source Solvent Evap											
1. Dry Cleaning	1.090	0	0	0	0	0	0	1.00	0	0	0
2. Surface Cleaning	1.016	26	3	29	26	3	30	1.00	26	3	30
Non-Indust. Surface Coating:											
1. Arch. Coating	1.027	46	7	53	47	7	55	0.80	38	6	44
2. Auto Refinish.	1.155	23	4	27	27	4	31	0.60	16	2	18
3. Traffic Marking	1.027	5	1	6	5	1	6	0.40	2	0	2
Indust. Coating:											
1. Furniture	1.029	13	2	14	13	2	15	1.00	13	2	15
2. Metal Containers	1.027	12	2	14	12	2	14	1.00	12	2	14
3. Motor Vehicles New	1.000	25	1	26	25	1	26	1.00	25	1	26
4. Machin. & Equip.	1.000	10	1	11	10	1	11	1.00	10	1	11
5. Appliances	1.002	0	0	0	0	0	0	1.00	0	0	0
6. Other Transportation Equip.	1.072	1	0	1	1	0	1	1.00	1	0	1
7. Metal Sheet, Strip, Coil	1.017	6	2	7	6	2	7	1.00	6	2	7
8. Factory Finished Wood	1.080	5	1	6	5	1	7	1.00	5	1	7
9. Elect. Insulation	1.004	3	1	4	3	1	4	1.00	3	1	4
10. Other Product Coating	1.027	6	1	7	6	1	7	1.00	6	1	7
11. High Perf. Maintenance	1.027	8	1	9	8	1	10	1.00	8	1	10
12. Marine Coatings	1.072	1	0	1	1	0	1	1.00	1	0	1
13. Oth. Specity Purpose Ctngs	1.027	8	1	9	8	1	10	1.00	8	1	10
Graphic Arts.	1.027	10	2	12	10	2	12	1.00	10	2	12
Cutback & Emulsified Asphalt (comb	1.027	0	0	0	0	0	0	1.00	0	0	0
Comm./Consumer Solvent.	1.027	45	7	52	46	7	53	0.82	38	6	44
Pesticide Use	1.027	4	2	6	4	2	6	1.00	4	2	6
Misc. Emissions											
1. Bakeries	1.022	5	1	6	5	1	6	1.00	5	1	6
2. Petroleum Spills	1.016	2	0	2	2	0	2	1.00	2	0	2
3. Asphalt Roofing	1.022	0	0	0	0	0	0	1.00	0	0	0
4. Leaking UST	1.016	0	0	0	0	0	0	1.00	0	0	0
5. Chemical Storage Tanks	1.016	6	0	7	6	0	7	1.00	6	0	7
Small Stationary Fuel Combustion	1.000	2	0	2	2	0	2	1.00	2	0	2
Forest Fires.	1.000	0	0	0	0	0	0	1.00	0	0	0
Solid Waste Incineration.86											
1. Residential	1.022	0	0	0	0	0	0	1.00	0	0	0
2. Comm./Institutional	1.022	0	0	0	0	0	0	1.00	0	0	0
3. Industrial	1.016	0	0	0	0	0	0	1.00	0	0	0
Structural Fires	1.022	2	0	3	2	0	3	1.00	2	0	3
Food Preparation											
1. Backyard Grills	1.022	3	0	3	3	0	3	1.00	3	0	3
2. Commercial Charbroiling	1.022	1	0	1	1	0	2	1.00	1	0	2
Area Source Sum (minus perchloroethylene)		313	49	362	325	52	376		290	47	337
On-Road Mobile (1996 EF)											
1. Urban	1.149			0	0	0	0		0	0	0
2. Small Urban	1.209			0	0	0	0		0	0	0
3. Rural	1.167			0	0	0	0		0	0	0
4. Total	1.156	183	38	221	215	46	260	0.53	125	27	152
		(90VMT*96EF)			(96VMT*96EF - unc)				(96VMT*96EF - cntl)		
On road mobile source sum		183	38	221	215	46	260		125	27	152
Aircraft Operations					0	0					
1. Logan	1.022	5	0	5	5	0	5	1.00	5	0	5
2. Others	1.093	0	0	1	0	0	1	1.00	0	0	1
Railroads:	0.879	0	0	1	0	0	1	1.00	0	0	1
Marine Vessels:											
1. Recreation (incl. in off-hghwy)	1.022			0	0	0	0	1.00	0	0	0
2. Commercial	1.078	1	0	1	1	0	1	1.00	1	0	1
Off-Highway:											
Total off-highway emissions	1.022	172	29	201	176	30	206	na	169	29	198
1. Farm Equip.	1.107			0	0	0	0	1.00	0	0	0
2. Construction Equip.	1.064			0	0	0	0	1.00	0	0	0
3. Industrial Equip	1.016			0	0	0	0	1.00	0	0	0
4. Off-road Motorcycles	1.022			0	0	0	0	1.00	0	0	0
5. Lawn & Garden	1.022			0	0	0	0	1.00	0	0	0
6. Snowmobiles	1.022			0	0	0	0	1.00	0	0	0
Off road mobile source sum		178	30	208	182	30	213		176	29	205
TOTAL		674	118	792	722	128	849		591	103	694
Stationary Sources	1.016	46	10	56	47	10	57	0.79	37	8	45
		720	128	848	769	138	906		628	111	739
							Target Level of Emissions		611	108	719

MASSACHUSETTS STATE IMPLEMENTATION PLAN (SIP)
SUBMITTAL SUMMARY SHEET
(November 15, 1994)

SUBMITTAL TITLE: Public Notice and Comment

CAAA CITATION:

40 CFR 51.102

ACTION TYPE:
- ■ Full Submittal
- ☐ Committal
- ☐ Certification
- ☐ Opt-in/Opt-out

STATUS: ■ Final ☐ Draft

SUMMARY:

Regulation: final/draft ☐ attached ■ N/A
Letter from Governor or Designee: final/draft ☐ attached ■ N/A
Date released for public review (notice):
Dates of public hearings:

Date comment period closed:
Date of adoption: ☐ actual ☐ estimated ■ N/A
Effective date: ☐ actual ☐ estimated ■ N/A

Work plan: final/draft ☐ attached ■ N/A
Schedule -- adoption of program: final/draft ☐ attached ■ N/A
Schedule -- implementation: final/draft ☐ attached ■ N/A

Comments:

The Department of Environmental Protection conducted public hearings on the proposed SIP revision under the provisions of Chapter 30A of the Massachusetts General Law. Attached are the following which document this process:

Notice of Public Hearing
Public Comments on the Proposed SIP Revision and Response to Comments
Hearing Officers Certification

DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF AIR QUALITY CONTROL

N O T I C E

Notice is hereby given that the Department of Environmental Protection (DEP), acting in accordance with the provisions of M.G.L. chapter 111, Sections 142B and 142D, will hold public hearings on proposed revisions to the Massachusetts State Implementation Plan (SIP) for ozone. The proposed revisions will consist of the Post-1996 Rate-of Progress Plan, which includes the 1999 Target Reduction Calculation and the Demonstration of the 9% Reduction. Included are adjustments to the 1990 Base Year and 1996 Projection Year Inventories consistent with quality assurance procedures.

These revisions are required by the Federal Clean Air Act Amendments of 1990.

The proposed Rate-of-Progress Plan describes how the Commonwealth will achieve a reduction in emissions of volatile organic compounds (VOC) by at least 3% per year over a three year period from 1996-1999, net of growth, and describes how NOx emission reductions will be substituted for VOC emission reductions, on a percent-to-percent basis.

These hearings are being held to gather public comments on the abovementioned revisions before they are submitted to the United States Environmental Protection Agency (EPA) as a revision to the Massachusetts SIP for ozone.

Public hearings will be conducted under the provisions of Chapter 30A of the Massachusetts General Laws on:

Thursday, October 6, 1994 - Springfield - 10:00 AM
Springfield City Hall, Springfield, MA
Room 218 - 2nd Floor

Friday, October 7, 1994 - Boston - 10:00 AM
John W. McCormack Office Building, One Ashburton Place
Boston, MA
Conference Room One - 21st Floor

Both public hearing sites are wheelchair accessible.

Testimony may be presented orally or in writing at the public hearings. Written comments will be accepted until 5:00 PM on Tuesday, October 11, 1994. Please submit three copies of any written testimony. Written testimony must be submitted to:

(OVER, PLEASE)

94 SEP -2 AM 10:20
SECRETARY OF STATE

Department of Environmental Protection
Division of Air Quality Control
One Winter Street, 7th Floor
Boston, MA 02108
Attention: Leah Weiss

Copies of the proposed revisions and supporting background information will be available for inspection during normal business hours at: DEP, Division of Air Quality Control, One Winter Street, Boston, MA and the four regional offices of DEP. For more information, contact Leah Weiss at (617) 292-5520.

By Order of the Department
Thomas B. Powers
Acting Commissioner

THE COMMONWEALTH OF MASSACHUSETTS

DEPARTMENT OF ENVIRONMENTAL PROTECTION

BUREAU OF WASTE PREVENTION

DIVISION OF AIR QUALITY CONTROL

SUMMARY OF COMMENTS AND RESPONSE TO COMMENTS

FROM THE

PUBLIC HEARINGS

ON THE PROPOSED MASSACHUSETTS STATE IMPLEMENTATION PLAN:

REASONABLE FURTHER PROGRESS DEMONSTRATION
(POST-1996 RATE-OF PROGRESS PLAN)

INVENTORY ADJUSTMENTS

REGULATORY AUTHORITY:

M.G.L. C. 111, SECTION 142B AND 142D

November, 1994

ORGANIZATIONS AND INDIVIDUALS WHO SUBMITTED TESTIMONY

(1) Clean Air Action Corporation

(2) Conservation Law Foundation

(3) Metropolitan Area Planning Council

(4) New England Electric Systems

(5) Northeast Utilities Service Company

(6) Twin Rivers Technologies

(7) United States Environmental Protection Agency

OVERVIEW

The Department of Environmental Protection (DEP) welcomes the input and suggestions from the parties who testified at the public hearings, held October 6-7, 1994, on the revision to the Massachusetts State Implementation Plan for Ozone. This document summarizes the comments received by topic and provides the DEP responses to those comments. Major topics on which the DEP received comments were:

For the Reasonable Further Progress Demonstration:

- NO_x Reductions and NO_x Substitution
- Mobile Source Emissions
- Growth in Emissions

For the Adjustments to the Inventory:

- 1990 Base Year Inventory
- Revised VOC Target Levels
- Conformity Issues

Other SIP-related issues commented upon included:

- 15% Rate of Progress Strategies
- Transportation Control Measures
- Attainment and Maintenance
- Contingencies
- Miscellaneous

In some cases, there were several comments addressing the same topic. In these cases, the various points of view have been summarized with a single DEP response. The DEP thanks all of the parties who participated in the review of this SIP revision.

REASONABLE FURTHER PROGRESS DEMONSTRATION

NO_x Reductions and NO_x Substitution

Comment: For the Western Massachusetts non-attainment area, the data show a 1999 controlled NO_x emission level of 94 tpsd, which is 2 tons above the target level of 92 tpsd. As a result, the proposed plan does not show that it can meet its target in Western Massachusetts. Since Massachusetts has two distinct ozone non-attainment areas, it must show the 9% rate-of-progress for each area. Massachusetts might close this shortfall by

claiming reductions by 1999 from new standards for non-road heavy-duty diesel engines, when that guidance is issued. (7)

Response: DEP acknowledges this comment. Further refinement in calculating the emission reductions from stationary and non-road sources in the final 1999 Projected Emissions Inventory now demonstrates that Western Massachusetts meets the Target Level of Emissions.

Comment: DEP needs to include the specific calculations used to estimate the benefits from its NO_x RACT rule. To do this, DEP must identify the specific companies that will achieve NO_x reductions by 1999 pursuant to the NO_x RACT rule and determine the total emission reductions by summing the reductions from the individual facilities. (7)

Response: In development of a strategy, DEP estimates the average reduction achievable by a group of sources if a certain standard were applied. This is similar to the methodology EPA uses to develop Control Technology Guidance Documents (CTGs). As a program is implemented, some subject sources will reduce more, and others less, than the average. DEP has included a DRAFT summary of the expected NO_x RACT reductions. This is contained as part of the 1999 Projected Emissions Inventory Technical Support, contained in Section B5 of this SIP submittal.

Unlike past SIPs, the DEP has adopted an Emission Control Plan (ECP) process to better track the emission reductions attributable to implementation of RACT. Once DEP has approved ECPs submitted by the sources in a particular category, a more accurate assessment of the reduction can be determined. DEP will share that information with EPA. If, in its implementation, a control program does not achieve the anticipated reductions, the Clean Air Act requires the state to make up that shortfall to avoid missing a milestone. The Clean Air Act has provisions which address this, such as Rate-of-Progress tracking and the triggering of contingency measures.

Comment: There is support and agreement with the NO_x substitution for the 1999 Rate-of-Progress Demonstration. (2)(4)(7)

Response: The DEP concurs that NO_x substitution is appropriate for the 1999 Rate-of-Progress Demonstration.

Comment: New England Electric Systems (NEES) supports the substitution of NO_x for VOC reductions as a lowest cost pollution control measure. It is believed that the NO_x RACT emission reduction numbers presented in the plan underestimates the real reductions achieved, and therefore incorporates a healthy conservatism in the Rate-of-Progress

calculations. NEES alone would achieve a reduction of 85 tpsd from NO_x RACT controls. If additional NO_x reductions are needed for attainment, they are available. (4)

Response: As the DEP approves Emission Control Plans to implement NO_x RACT, a better assessment of the true reductions from this rule will be known. The DEP tried, in the 9% plan proposal, to develop a fair estimate of the potential reductions across affected source categories.

Comment: Concerns were expressed that the DEP chose to base its entire Post-1996 Rate-of-Progress Plan on reductions in NO_x emissions. This strategy sends the wrong signal to the public regarding what types of emission reductions are needed for attainment. DEP is encouraged to include at least token level VOC reductions as part of its Rate-of-Progress plan. (5)

Response: There has been substantial modeling done which indicates that NO_x reductions would produce larger ozone reductions than solely VOC controls in many areas of the Northeast. For that reason, NO_x control strategies have been embodied in the 9% Rate-of-Progress plan. The overall reduction plan includes the 15% Rate-of-Progress plan reductions of VOC emissions only, between 1990 and 1996. That plan was initially submitted to the EPA in November, 1993. Together, these two plans constitute a significant reduction in both VOC and NO_x. As we move forward towards attainment, both VOC and NO_x reduction programs will be assessed.

Mobile Source Emissions

Comment: There needs to be a further explanation or inclusion of the actual modeling used to forecast the 1999 uncontrolled and controlled mobile source emissions for both VOC and NO_x. Review of the data files should make review of the final plan easier. (7)

Response: The technical support documentation requested by the EPA was submitted under separate cover. Hard copies of the Mobile5a input files for the final 9% plan will accompany submittal of that plan to the EPA.

Growth in Emissions

Comment: The state must offset any growth in VOC emissions between 1996 and 1999 with VOC emissions. The document ignores that these VOC reductions are needed, by asserting that NO_x substitution is sufficient to meet the 9% reduction. (2)

Response: Discussions with and guidance from the EPA's Office of Air Quality Planning and Standards (OAQPS) have indicated that NO_x may be substituted to offset growth in VOC

emissions above the 1996 target level, provided that the substitution is consistent with the state's attainment demonstration.

ADJUSTMENTS TO THE INVENTORY

Revised 1990 Base Year VOC Emission Inventory

Comment: The EPA cannot approve the methodology used by Massachusetts to adjust the non-road portion of the base year emissions inventory. Massachusetts must therefore make the necessary corrections. This could be done by using the original EPA Office of Mobile Sources (OMS) emissions estimates, or by using the March 17, 1994 OMS guidance on non-road emissions. Concurrently, the numbers in AIRS should be changed to be identical to these corrections. (7)

Response: It has become apparent to DEP that the EPA will not accept any alternative methodology for characterizing non-road emissions. Given the ramifications associated with not following EPA guidance, DEP has agreed to adjust its inventory and the AIRS data accordingly.

Revised VOC Target Levels

Comment: The revised 1996 target levels and projected emission inventory illustrates that Massachusetts has not developed an emission reduction plan that meets the requirements of section 182(b)(1)(A), providing for a 15% reduction in VOC from 1990 baseline levels by November 15, 1996. DEP's background document does not explicitly acknowledge the failure of the Commonwealth to meet the 1999 target level for VOC. DEP is also encouraged to indicate a time frame as to when these issues will be addressed. (2) (7)

Response: The DEP acknowledges that a shortfall was indicated in meeting the 1996 target level of emissions and that this shortfall carried through into the 1999 Reasonable Further Progress Demonstration. The DEP plans to address this issue through a separate public hearing process, and considers it separate from the 1999 target level for NO_x emissions. Within the background document for the revision to the 15% Rate-of-Progress Plan every effort will be made to provide context for the proposed revisions, and to indicate the time frame for all regulatory actions required pursuant to revised plan. Once the 1996 VOC shortfall is addressed, both the 1996 and 1999 plans will demonstrate Reasonable Further Progress, since NO_x is being substituted for VOC after 1996.

Comment: Step Three of the 1996 VOC target emission level calculation for the on-road portion of the adjusted base-year inventory was not calculated using a value of 9.0 psi Reid

Vapor Pressure (RVP), as allowed in EPA guidance. Massachusetts should consider revising its target level calculation in accordance with the guidance. (7)

Response: The DEP has agreed to recalculate the 1996 VOC target emission level in accordance with the suggested guidance.

Comment: The EPA requests that Massachusetts keep it advised of the status of the updating of transportation modeling capabilities through the use of demand models throughout the state, as well as any request to revise the 1990 or projected inventories to reflect the new information. (7)

Response: The DEP will oblige the request. Any revision to update the 1990 or projected inventories to reflect transportation demand modeling would be subject to EPA and public review.

Comment: The projected emission inventories for 1996 and 1999 for the non-road sector must be adjusted to comply with EPA guidance. (7)

Response: Despite concerns regarding the EPA Office of Mobile Sources guidance on non-road engines, the DEP has agreed to recalculate the projected emission inventories in accordance with the guidance.

Conformity Issues

Comment: Any deficiencies in the 15% Rate-of-Progress Plan, as a result of adjustments in the inventories and target calculations, will affect conformity findings for the Massachusetts Transportation Plans and Transportation Improvement Plans. Without identified strategies to meet the required emissions reductions, the mobile source budget is inadequate for use in making conformity determinations. To maintain a "protective finding" for conformity, Massachusetts must submit a revised 15% SIP identifying strategies to meet the revised target level shortfall. This revision must include appropriate corrections to non-road VOC emission calculations. If a revised 15% SIP revision is not submitted by January 26, 1995, conformity findings cannot be made. (7)

Response: The DEP will work diligently to restore the protective finding, and will bring a plan out to public hearing on identified strategies to make up the shortfall as soon as possible.

OTHER SIP ISSUES

15% Rate of Progress Strategies

Comment: Given that Massachusetts must identify and submit strategies to fill the gap identified by the shortfall described above, EPA commented on a list of strategies with potential to meet the required target levels. They included: BACT controls; Cleaner Diesel Fuel for Off-Road Vehicles; I/M for Heavy Duty Gasoline Vehicles; Expanded Consumer & Commercial Products Rule; Development of Aerosol Paint Products Rule; Economic Incentive Program (EIP) for Marine Vessels Maintenance; Rule Effectiveness Improvements for Stage I, Stage II, and other VOC regulations; and ASTM Class B Reformulated Gasoline. EPA believes that a submittal, prior to January 26, 1995, which includes a combination of these measures, with the exception of the EIP for Marine Vessels, could retain a protective finding for conformity. (7)

Response: The DEP will consider the EPA's comments on each of these strategies, particularly with respect to creditability for SIP purposes, and will propose a revision to the 15% Rate-of-Progress Plan with a viable combination of control strategies. The DEP further commits to expediting a public hearing on the revised plan with every intent to formally submit the SIP revision to the EPA by January 26, 1995.

Comment: Reductions from the use of reformulated gasoline in non-road engines in the 15% plan assumes an 11% reduction, based on the Massachusetts non-road methodology which has been rejected by the EPA, pursuant to the March 17, 1994 OMS guidance. Reductions from this program must be recalculated by segregating out the emissions from 2-stroke and 4-stroke gasoline engines and by applying the appropriate factors as stated in the guidance. (7)

Response: The 11% reduction shown in the Table represents the equivalent overall reduction in off-road emissions as determined by using EPA guidance on individual components of the Massachusetts off-road inventory. Massachusetts has since recalculated those reductions using EPA off-road inventory numbers. The summary Table, however, will continue to show the overall reduction in the off-road category.

Comment: Massachusetts needs to identify the specific point sources that will achieve emission reductions by 1996 pursuant to VOC RACT and RACT rule corrections. A work assignment is currently underway to provide assistance to Massachusetts in identifying the correct ozone season daily emissions from point sources within the State. (7)

Response: In development of a strategy, DEP estimates the average reduction achievable by a group of sources if a certain standard were applied. This is similar to the methodology

EPA uses to develop Control Technology Guidance Documents (CTGs). As a program is implemented, some subject sources will reduce more, and others less, than the average. The DEP has already submitted preliminary lists of sources to EPA, in both its 1992 and 1993 November SIP submittals. However, for this SIP, unlike past SIPs, the DEP has adopted an Emission Control Plan (ECP) process to better track and implement the emission reductions attributable to implementation of RACT and RACT corrections. Once DEP has approved ECPs submitted by the sources in a particular category, a more accurate assessment of the reduction can be determined. While Massachusetts appreciates EPA's effort on its behalf in refining daily emissions estimates from point sources, we look forward to working with the EPA in the future on sectors of VOC emitting sources that are more significant to our overall plan to achieve clean air.

Comment: In the revised 1996 projection inventory, Massachusetts claims 40% reductions in the automotive refinishing sector from the Automotive Refinishing regulation (310 CMR 7.18(28)). DEP must demonstrate that the existing regulation will achieve this level of reduction. (7)

Response: While emissions standards for the topcoat category are slightly (4%) less stringent than EPA's suggested control level, other sections of Massachusetts' regulation are more stringent, and more than make up the difference. Examples of this include equipment requirements and operating procedures. Further details on this can be found in the Response to Comments Document for the Automotive Refinishing Controls regulation, which will be submitted to the EPA shortly.

Comment: The revisions to the marine volatile liquid transfer controls portion of the inventory are inconsistent with the data contained in the August, 1994 background document for the proposed regulation for that source category (310 CMR 7.24(8)). The discrepancies should be resolved. (7)

Response: The discrepancies identified as a result of the inventory adjustments will be corrected and reflected in the final submittal of the marine volatile organic liquid transfer controls regulation as a SIP revision to the EPA.

Comment: Massachusetts should consider adopting a state rule controlling VOC emissions from municipal solid waste landfills to address the 15% shortfall. This was originally proposed as a contingency measure. (7)

Response: The DEP continues to consider this strategy a viable contingency measure, and is not proceeding further at this time.

Comment: A report was submitted into the record indicating that the implementation of a biodiesel program as applied for MBTA buses could yield 1.69 tpsd of VOC reductions and 0.15 tpsd of NO_x reductions. (6)

Response: The DEP will review the materials in assessing control strategies for the VOC shortfall, as well as strategies for attainment and maintenance.

Transportation Control Measures

Comment: Several comments were received about the importance of Transportation control measures (TCMs), citing the additional non-air quality benefits they provide. The DEP was encouraged to put improved parking measures, including strengthened parking supply management and promotion of increased ridesharing and transit use, into the SIP, to place greater priority on their implementation, and pursue market-based initiatives and land use measures to control the growth of vehicle miles travelled. (2)(3)

Response: The DEP recognizes the benefits of TCMs. TCMs have been in the SIP since 1975, and the DEP continues to address on-going implementation of such measures contained within the SIP to the extent possible. Commenters are encouraged to continue participation in SIP planning with the DEP and the appointed authority for transportation planning under the auspices of the Clean Air Act in Massachusetts, i.e., the Executive Office of Transportation and Construction.

Comment: The DEP should continue efforts to strengthen and revamp the existing Rideshare regulation without delay. (2)(3)

Response: The DEP will continue to address enhancements to the Rideshare regulation as resources permit.

Comment: The current SIP submittal demonstrates that TCMs are not needed for attaining clean air, yet the current attainment is based on the implementation of SIP measures including the Rideshare regulation. (3)

Response: The current SIP does not address attainment of clean air, and only address the 15% and 9% emission reduction milestones. Virtually all regulatory programs implemented prior to 1990 are considered to be part of the base year 1990, from which all mandated reductions are calculated. As such, the current Rideshare regulation is part of the baseline.

Contingencies

Comment: The revisions to the 15% rate of progress plan do not contain the necessary contingency measures which are required to be identified. (7)

Response: The issue of contingency measures is considered separate from the scope of this hearing. However, the DEP plans to adopt a contingency plan and contingency measures in conjunction with development of the attainment plan and the emission reduction needs identified by the modeling. In this manner the DEP can maximize emission reduction selection to provide a strong control program and contingencies.

Attainment and Maintenance

Comment: It is attainment and maintenance, rather than the interim milestones, which will require the most effort to achieve, and these objectives should not be relegated to the back burner. (2)

Response: Given delays in the modeling necessary to show attainment, Massachusetts thought it irresponsible to "do nothing" and wait for modeling. The forwarding of a 9% plan demonstrates the Commonwealth's commitment to clean air and continued improvements. The DEP is dedicating significant time and resources to do the modeling and the eventual attainment plan. Rather than consider this work "back burner," it is at the forefront of our effort.

Comment: MAPC is pleased that additional economically painful measures do not have to be undertaken in order to achieve the goals of the Clean Air Act. (3)

Response: It is important to clarify that meeting the 1999 milestone does not constitute achieving the full complement of Clean Air Act goals. The DEP has yet to make up the shortfall recently identified in its 15% Rate-of-Progress Plan. In addition, the DEP has not yet ascertained whether and what additional measures may need to be implemented in order to attain the ozone standard and maintain it over time. This latter issue will be more adequately characterized when the DEP's Urban Airshed Modeling work is completed, and will be subject to the public hearing process.

Miscellaneous

Comment: Clean Air Action Corporation supports DEP's efforts to include emissions trading elements in its air regulatory programs. (1)

Response: The DEP acknowledges the comment.

Comment: DEP should change its current Emissions Banking and Trading regulation to allow more free intersector trading, in light of the NO_x substitution allowed in the Rate-of-Progress plan. (1)

Response: Though it is known that both VOX and NO_x are precursors to ozone formation, it is not completely known how the relationship between the two translate to ozone production on the microscale. Because of this scientific uncertainty, allowing trading between the two precursors would be premature at this time. The guidance on NO_x substitution for VOC, written by the EPA, applies to Reasonable Further Progress requirements for the 1996-1999 time frame over the broader northeast region. Eventually, substitution of NO_x for VOC must be supported by modeling which demonstrates that NO_x reductions are necessary for attainment in the New England domain, and that the amount of reductions are consistent with the attainment demonstration.

Comment: Concerns were raised with regard to Central Artery commitments. It was expressed that the transit and commuter parking requirements have not yet been submitted to the EPA for inclusion in the SIP, that their adoption came about with little documentation of air quality benefits, and that at full implementation one of the projects would result in an increase in air pollution emissions. It was requested that DEP withdraw the Central Artery commitments from consideration. (3)

Response: The High Occupancy Vehicle and Transit Improvement regulations were submitted to EPA for inclusion in the SIP in December, 1991, and were published in the Federal Register on October 4, 1994 (FR 50495), with an effective date of November 3, 1994. The SIP revision which was subject to public review in 1991 included an assessment of air quality benefits. At this time the DEP has no intention of withdrawing these measures from the SIP.

Comment: Concerns were expressed that the Commonwealth elected not to join the regional NO_x control program embodied in the recently approved Memorandum of Understanding (MOU) amongst most of the Ozone Transport Commission (OTC) states. The MOU is clearly a step in the right direction, and DEP is strongly encouraged to join the other OTC states in signing the MOU. (5)

Response: According to OTC rules of conduct, states may sign on to an MOU at any time. At the September 27, 1994 meeting of the OTC, when the MOU was discussed and initially signed, Trudy Coxe, Secretary of the Executive Office of Environmental Affairs for Massachusetts voiced her concerns regarding certain technical aspects of regional strategy as embodied in the MOU. She further stressed that signing onto the existing MOU, without adequate modeling to support such a decision, was premature. Ms. Coxe indicated that Massachusetts was prepared to sign on if DEP's attainment modeling supported the implementation of the specifics of that particular NO_x regional strategy. When DEP's Urban Airshed Modeling work has been completed, this issue will be reassessed.

Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Environmental Protection

William F. Weld
Governor
Trudy Coxe
Secretary, EOEA
Thomas B. Powers
Acting Commissioner

CERTIFICATION

RE: Public Review process on the proposal to amend the Massachusetts State Implementation Plan for Ozone. The amendments consist of the Post-1996 Rate-of Progress Plan, which includes the 1999 Target Reduction Calculation and the Demonstration of the 9% Reduction. Included are adjustments to the 1990 Base Year and 1996 Projection Year Inventories for Volatile Organic Compounds, Nitrogen Oxides, and Carbon Monoxide, consistent with quality assurance procedures.

We hereby certify that:

Notices of the public hearing were published on the following dates in the following newspapers:

Boston Globe (Boston)	September 2, 1994
New Bedford Standard Times (New Bedford)	September 3, 1994
Cape Cod Standard Times (Hyannis)	September 5, 1994
Springfield Union News (Springfield)	September 6, 1994
Worcester Telegram (Worcester)	September 6, 1994

That the notices specified the date, time and place of the public hearings to be held on the proposed amendments to the Massachusetts State Implementation Plans for Ozone.

That the notices specified the locations at which the proposed revisions and supporting information were available for public inspection.

That the proposed revisions and supporting information were available at the locations stated in the notice when the notices were published as well as at the locations of the public hearings on the date of said hearings.

That similar notices were mailed on or before September 2, 1994 to the Environmental Protection Agency, to any affected local or pollution control agencies, and to all known potentially interested parties.

We further certify that on the following dates and at the following locations, public hearings were conducted by the Department of Environmental Protection, pursuant to the above notices and in conformance with M.G.L. Chapter 30A and the provisions of 30 CFR 51.4(b):

October 6, 1994 - Springfield, Massachusetts - 10:00 AM
Springfield City Hall, Room 218

October 7, 1994 - Boston, Massachusetts - 10:00 AM
John W. McCormack Office Building
One Ashburton Place, 21st Floor, Conference Room One

ATTEST: Laurel J Carlson 10-21-94

Laurel J. Carlson
Hearing Officer
October 19, 1994

ATTEST: Oct 19, 1994

Jerome Grafe
Hearing Officer
October 19, 1994

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